



United States
Department of
Agriculture

Forest
Service

National Forests in Mississippi

August 2010



Lands Available for Oil & Gas Leasing Environmental Assessment

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, or marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotope, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

**NATIONAL FORESTS IN MISSISSIPPI
LANDS AVAILABLE FOR OIL & GAS LEASING**

Environmental Assessment

Tippah, Benton, Marshall, Lafayette, Union, Pontotoc, Chickasaw, Yalobusha, Choctaw, Oktibbeha, Winston, Sharkey, Issaquena, Scott, Newton, Smith, Jasper, Jefferson, Copiah, Lincoln, Franklin, Adams, Wilkinson, Amite, Jones, Wayne, Greene, Pearl River, Forrest, Perry, George, Stone, Jackson, and Harrison Counties, Mississippi

Lead Agency:

USDA Forest Service

Responsible Official:

Margrett L. Boley, Forest Supervisor
NFsMS
100 Capitol St. Suite 1141
Jackson, MS 39269
(601) 965-1600

Cooperating Agency

USDI Bureau of Land Management
Eastern States Office
7450 Boston Boulevard
Springfield, VA 22153

For Information Contact:

Jim Michael, Project Manager
Forest Geologist
100 W. Capitol St. Suite 1141
Jackson, MS 39269
(601) 965-1667

or

Robert Bradford
Environmental Coordinator
100 W. Capitol St. Suite 1141
Jackson, MS 39269
(601) 965-1605

This page intentionally left blank.

Table of Contents

Section	Page
CHAPTER 1 PURPOSE AND NEED FOR ACTION.....	1
1.1 Introduction.....	1
1.2 Proposed Action.....	1
1.3 Purpose and Need for Action.....	2
1.4 Scope of the Analysis.....	3
1.4.1 Geographic Scope	3
1.4.2 Temporal Scope	6
1.4.3 Administrative Scope.....	6
1.5 Connected and Cumulative Actions.....	7
1.6 Forest Plan Context.....	7
1.7 Decisions to Be Made	8
1.8 The Analysis Process	8
1.9 Scoping and Public Involvement	9
1.10 Issues.....	9
1.10.1 Mineral Resources.....	9
1.10.2 Soil Productivity	10
1.10.3 Water Resources	10
1.10.4 Air	10
1.10.5 Transportation System	10
1.10.6 Vegetation	11
1.10.7 Wildlife	11
1.10.8 Cultural Resources	11
1.10.9 Recreational Opportunities	11
1.10.10 Military Training Areas	12
1.10.11 Visual Resources.....	12
1.10.12 Climate Change.....	12
1.10.13 Economic Effects.....	12
1.11 Design Criteria	13
CHAPTER 2 THE ALTERNATIVES CONSIDERED	15
2.1 Introduction.....	15
2.2 Alternatives.....	15
2.2.1 Alternative 1 – No Action Alternative	15
2.2.2 Alternative 2 – Lands Available for Leasing Alternative	15
2.3 Alternative Considered But Eliminated from Further Study	18
2.4 Environmental Protection Measures Common to All Alternatives.....	18

Table of Contents (cont'd)

Section	Page
2.5 Comparison of Alternatives	21
CHAPTER 3 ENVIRONMENTAL CONSEQUENCES	23
3.1 Introduction.....	23
3.2 Reasonable Foreseeable Development Scenario (RFDS)	23
3.2.1 RFDS-Alternative 1 (No Action Alternative)	25
3.2.2 RFDS-Alternative 2 (Lands Available for Leasing Alternative)	26
3.2.3 RFDS-Life Expectancy of Oil and Gas Wells and Operations	29
3.2.4 RFDS Common to All Alternatives: Private Minerals on NFS Lands	30
3.3 Affected Environment and Environmental Effects	32
3.3.1 Mineral Resources	32
3.3.2 Soil Productivity	35
3.3.3 Water Resources	39
3.4 Air	41
3.4.1 Current Condition	41
3.4.2 Environmental Effects – Alternative 1 – No Action	42
3.4.3 Environmental Effects – Alternative 2 – Lands Available for Leasing	42
3.5 Transportation System	43
3.5.1 Current Condition	43
3.5.2 Environmental Effects – Alternative 1 – No Action	43
3.5.3 Environmental Effects – Alternative 2 – Lands Available for Leasing	43
3.6 Vegetation	44
3.6.1 Current Condition	44
3.6.2 Environmental Effects – Alternative 1 – No Action	46
3.6.3 Environmental Effects – Alternative 2 – Lands Available for Leasing	46
3.7 Wildlife	47
3.7.1 Current Condition	47
3.7.2 Threatened, Endangered, Sensitive Species.....	47

Table of Contents (cont'd)

Section	Page
3.7.3 Management Indicator Species	51
3.7.4 Migratory Landbird Conservation	55
3.8 Cultural Resources	55
3.8.1 Current Condition	55
3.8.2 Environmental Effects – Alternative 1 – No Action.....	57
3.8.3 Environmental Effects – Alternative 2 – Lands Available for Leasing	57
3.9 Recreational Opportunities	58
3.9.1 Wilderness Areas	58
3.9.2 Developed and Dispersed Recreation	59
3.9.3 Special Areas	60
3.10 Military Training Areas	61
3.10.1 Camp Keller, Harrison County	61
3.10.2 Camp Shelby Military Training Facility – Forrest and Perry Counties	62
3.11 Visual Resources.....	66
3.11.1 Current Condition	66
3.11.2 Environmental Effects – Alternative 1 – No Action.....	67
3.11.3 Environmental Effects – Alternative 2 – Lands Available for Leasing.....	67
3.12 Climate Change.....	68
3.12.1 Current Condition	68
3.12.2 Environmental Effects – Alternative 1 – No Action.....	71
3.12.3 Environmental Effects – Alternative 2 – Lands Available for Leasing	72
3.13 Economic Effects	72
3.13.1 Current Condition	72
3.13.2 Environmental Effects – Alternative 1 – No Action.....	75
3.13.3 Environmental Effects – Alternative 2 – Lands Available for Leasing	76

Table of Contents (cont'd)

Section	Page
CHAPTER 4 LIST OF PREPARERS AND CONSULTATION.....	79
4.1 List of Preparers.....	79
4.2 List of Individuals and Organizations Contacted.....	79
CHAPTER 5 REFERENCES.....	81
APPENDICES	
Appendix A: SCOPING INFORMATION	
Appendix B: FEDERAL OIL AND GAS LEASE STIPULATIONS AND RELATED MAPS	
Appendix C: REASONABLE FORESEEABLE DEVELOPMENT SCENARIO (RFDS)	
Appendix D: BIOLOGICAL EVALUATION	
Appendix E: MANAGEMENT INDICATOR SPECIES (MIS) INFORMATION	
Appendix F: RESPONSE TO COMMENTS	
Appendix G: JOHN DYKES, BLM-JF0, COMMUNICATIONS	
Appendix H: DOE, MODERN SHALE GAS – A PRIMER	
Appendix I: NFsMS-CLIMATE CHANGE TRENDS AND STRATEGIES	

List of Tables

Table	Page
1	Acres and Percent of NFS Lands within the Proclamation Boundaries5
2	Comparison of Alternatives.....21
3	Estimation of Surface Disturbance Based Upon Projected Number of Wells on NFS Lands within Proclamation Boundary of NFsMS24
4	Acres and Percent of Federal Oil and Gas Leases on NFsMS25
5	Estimation of Surface Disturbance Based Upon Projected Number of Wells on Existing Federal Oil & Gas Leases on NFsMS-Alternative 1 (Indirect Effects)26
6	Acres and Percent of NFS Lands Not Currently in Federal Oil & Gas Leases on NFsMS27
7	Estimation of Surface Disturbance Based Upon Projected Number of Wells on Future Federal Oil & Gas Leases on NFsMS28
8	Estimation of Surface Disturbance Based Upon Project Number of Wells on Existing and Future Federal Oil and Gas Leases on NFsMS – Alternative 2 Total29
9	Production Duration for 10,038 Oil and Gas Wells in Mississippi.....30
10	Projected Number of Productive & Non-Productive Federal Oil and Gas Wells to be Drilled on NFsMS by Alternative.....31
11	Acres and Percent of Private Mineral Rights on NFsMS32
12	Estimation of Surface Disturbance Based Upon Projected Number of Private Wells on NFsMS33
13	Current Condition – Federal Oil and Gas Leases on NFsMS.....34
14	Current Effects of Associated Exploration and Development to Alternative 1 on TES Species48
15	Potential Effects of Associated Exploration and Development to Alternative 2 on TES Species50
16	Potential Current Effects of Associated Exploration and Development to Alternative 1 on MIS52

List of Tables (cont'd)

Table	Page
17	Current Effects of Associated Exploration and Development to Alternative 2 on MIS54
18	Cultural Resource Significance Evaluation Criteria.....56
19	Special Areas Located on the National Forests in Mississippi.....60
20	Annual Federal Revenue and Mississippi's 25 Percent Share from Onshore Federal Leases in Mississippi, 1996-200873
21	Estimate of Annual Revenue from Federal Oil and Gas Leases on NFsMS Contribution to 1) Federal Onshore Lease Revenue in Mississippi and 2) Mississippi's 25 Percent Share from Onshore Federal Leases in Mississippi, 1996-200874
22	Estimate of Alternative 1 Economic Investment Associated with Drilling and Completion (including installation of production facilities if applicable) of Projected Number of Wells (productive and non-productive) Over 15 Year RFDS on Existing Federal Leases on NFsMS76
23	Estimate of Economic Investment Associated with Drilling and Completion (including installation of production facilities if applicable) of Projected Number of Wells (productive and non-productive) Over 15 Year RFDS on Existing Federal Leases on NFsMS77
24	Comparison of Alternative Based on Estimate of Economic Investment Associated with Drilling and Completion (including installation of production facilities if applicable) of Projected Number of Wells (productive and non-productive) Over 15 Year RFDS on NFsMS78

List of Figures

Figure		Page
1	Map Locations of National Forests in Mississippi	4
2	Location of Mississippi's Physiographic Provinces	36
3	8-Hour Ozone Values (ppb), 2006-2008	42

This page intentionally left blank.

CHAPTER 1

PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

The authority to manage the exploration and development of mineral and energy resources within National Forest System (NFS) lands is jointly shared between the Secretary of Agriculture and the Secretary of the Interior, more specifically, the National Forest in Mississippi (NFsMS), and the Bureau of Land Management (BLM), as a cooperating agency. The Forest Service is responsible for managing the occupancy and use of the surface by persons conducting mineral activities on NFS lands subject to conditions prescribed to ensure adequate utilization of the lands for which they were acquired or are being administered. This minerals availability analysis will evaluate lands available for oil and gas leasing and satisfies the requirements of 36 CFR 228 to identify NFS lands that are administratively available for leasing.

1.2 PROPOSED ACTION

The Forest Service is proposing to make all lands on the NFsMS, except for Congressionally designated Wilderness areas (Black Creek and Leaf) and the Sandy Creek RARE II Further Study Area, available for Federal oil and gas leasing through the BLM. These lands, approximately 1.2 million acres, would be administratively available subject to 1) management direction in the NFsMS Land and Resource Management Plan (Forest Plan), 2) oil and gas lease stipulations, and 3) the wide range of laws and regulations that require environmental protections for oil and gas exploration and development (such as Clean Water Act, Clean Air Act, National Historic Preservation Act, Endangered Species Act, and Federal Onshore Oil and Gas Act of 1987).

The Sandy Creek RARE II Further Study Area is located on the Homochitto National Forest, Adams County, and contains a total of 2,375 acres. This area was originally identified in the January 1979 Final Environmental Impact Statement (FEIS) – Roadless Area Review and Evaluation (RARE II) and classified as a further study area (Area ID 083110). This RARE II Further Study Area was included in the 2000 Forest Service Roadless Area Conservation – FEIS for consideration as potential additional wilderness areas. Due to unresolved issues related to roadless, we’re deferring the decision on the Sandy Creek RARE II area.

All administratively available lands will be available for lease by BLM, subject to the stipulations identified in the analysis, the standard USDA stipulation, and the environmental requirements of the standard federal lease terms. In addition, the BLM proposes to offer for lease those NFS lands in Mississippi, as authorized by the Forest Service, subject to the stipulations identified by Forest Service. In addition to the environmental protections summarized above, design criteria considered in the analysis include Forest Plan Standard and Guidelines and State Best Management Practices (BMP), as appropriate. These would be included in future site-specific analysis of proposed Applications for Permits to Drill (APD), as appropriate.

Current oil and gas leases on the NFsMS would continue to be managed under existing leases until the leases expire, terminate, or are relinquished, at which time the area would be available and offered as specific lands subject to the conditions above.

1.3 PURPOSE AND NEED FOR ACTION

The purpose of and need for action are:

- To implement the Congressionally-mandated Federal oil and gas leasing program to help supply the nation with critical energy minerals and provide a source of revenue to local, state and Federal governments.
- To implement Congressional direction for Federal oil and gas leasing on NFS lands, as reflected in laws such as Mineral Leasing Act of 1920, Mineral Leasing Act for Acquired Lands of 1947, Mining and Minerals Policy Act of 1970, Energy Security Act of June 30, 1980, Federal Onshore Oil and Gas Act of 1987, Energy Policy Act of 2005. For example, the purpose of the Mineral Leasing Act for Acquired Lands of August 7, 1947 is “to promote the mining of coal, phosphate, sodium, potassium, oil, oil shale, gas, and sulphur on lands acquired by the United States.” The Federal Onshore Oil and Gas Act of 1987 and associated regulations 36 CFR 228 E, provides direction on leasing analysis and decisions on NFS lands. The Mining and Minerals Policy Act of 1970 states: “The Congress declares that it is the continuing policy of the Federal Government in the national interest to foster and encourage private enterprise in 1) the development of economically sound and stable domestic mining, minerals, metal and mineral reclamation industries, 2) the orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security and environmental needs..., For the purpose of this section “minerals” shall include all minerals and mineral fuels including oil, gas, coal, oil shale and uranium. It shall be the responsibility of the Secretary of the Interior to carry out this policy when exercising his authority under such programs as may be authorized by law other than this section.”
- To implement NFsMS Forest Plan management goal to emphasize mineral resources along with all other forest resources. The Forest Plan recognizes that demand is high for oil and gas, and provides for Federal oil and gas leasing on the NFsMS.
- To implement Forest Plan direction to manage minerals development on the NFsMS so as to optimize the use of these resources in a manner that contains suitable environmental safeguards.
- To respond to continuing interest by energy industry in obtaining Federal oil and gas leases and exploring and developing oil and gas on the NFsMS. Previous leasing has led to successful oil and gas exploration and development in the NFsMS. The BLM has received Expressions of Interest requesting more leasing on the NFsMS, and there is a need for the Forest Service and the BLM to respond to these as well as future requests for leasing (nominations and Expressions of Interest) on the NFsMS.
- To recognize the strategic role of the NFsMS in managing the Federal oil and gas resources in Mississippi. The NFsMS occupy approximately 67 percent of Federal mineral estate in Mississippi. As the largest Federal agency land management base in Mississippi, as a demonstrated producer of Federal oil and gas, and as a Federal agency with a Congressional-designated multiple-use mission, the NFsMS are key to the Federal oil and gas leasing program in Mississippi.

- To respond to the need for timely actions by Forest Service and the BLM on the Federal oil and gas leasing program as mandated by Congress and Executive Branch, including:
 - The Energy Security Act of June 30, 1980 directs the Secretary of Agriculture to process applications for leases and permits to explore, drill and develop resources on NFS lands, notwithstanding the current status of the Forest Plan.
 - Executive Order 13212 (Actions to Expedite Energy-Related Projects) of May 18, 2001 requires Federal agencies to “take appropriate actions, to the extent consistent with applicable law, to expedite projects that would increase the production, transmission, or conservation of energy.”
 - The Energy Policy Act of 2005 required the Secretary of Interior and the Secretary of Agriculture to enter into a memorandum of understanding (MOU) to ensure timely processing of oil and gas lease applications and surface use plans of operation, and eliminate duplication of effort by providing for coordination of planning and environmental compliance efforts. In 2006, the Forest Service and the BLM signed the MOU (*Memorandum of Understanding between United States Department of the Interior Bureau of Land Management and United States Department of Agriculture Forest Service Concerning Oil and Gas Leasing and Operations - BLM MOU WO300-2006-07; Forest Service Agreement No. 06-SU-11132428-052*). The MOU establishes joint BLM and Forest Service policies and procedures for timely environmental analysis of oil and gas leasing and operations on NFS lands.

1.4 SCOPE OF THE ANALYSIS

The scope of the proposed action is geographic, temporal, and administrative as described below.

1.4.1 Geographic Scope

The lands availability decision area includes the NFS lands with Federally-owned mineral rights within the proclamation boundaries of the six NFsMS: De Soto, Homochitto, Bienville, Delta, Tombigbee, and Holly Springs National Forests (Figure 1). Approximately 1.2 million acres of NFS lands are located within the NFsMS proclamation boundaries. The proclamation boundary, established by Congress, is the area within which the Federal Government may acquire tracts of land to become NFS lands. The rest of the land, about 1.15 million acres, within the proclamation boundaries is non-Federal land, mainly private land. The NFS lands and the non-Federal lands within each proclamation boundary are shown on the maps for the Controlled Use Stipulations (see Appendix B).

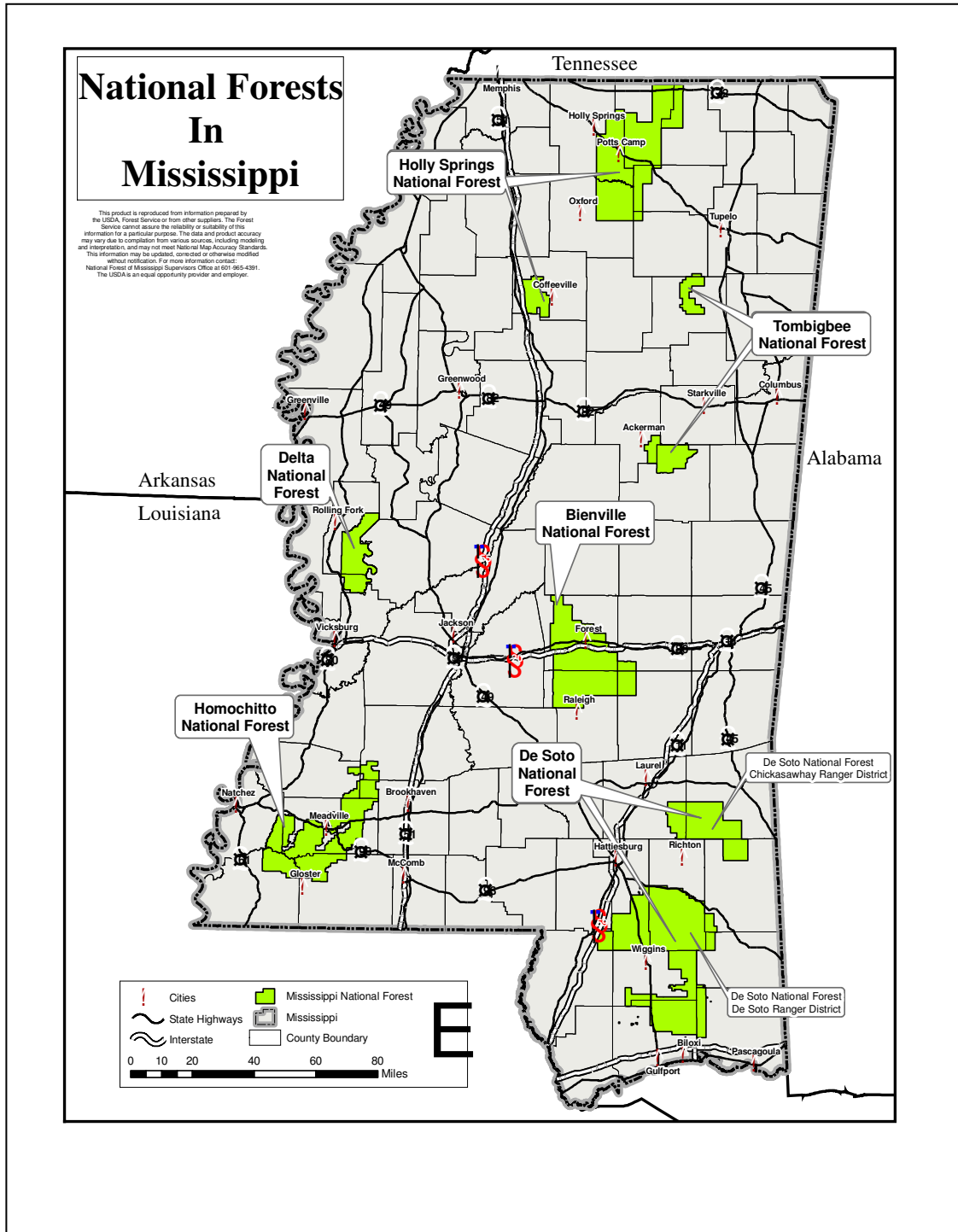


Figure 1. Map Locations of National Forests in Mississippi

Three of the NFsMS (De Soto, Holly Springs, and Tombigbee) have two proclamation boundaries, dividing these Forests into North and South Units. These six proclamation boundaries plus the three proclamation boundaries for the Homochitto, Bienville, and Delta result in nine proclamation boundaries for the six NFsMS. The acres of the NFS lands within the nine proclamation boundaries are shown in Table 1.

Table 1. Acres and Percent of NFS lands within the Proclamation Boundaries

National Forest	Total acres in proclamation boundary	Acres non-NFS lands in proclamation boundary	Acres NFS lands in proclamation boundary	Percent of NFS lands in proclamation boundary
Bienville	382,821	204,279	178,542	47%
Delta	118,150	57,252	60,898	52%
De Soto N Unit	232,292	83,237	150,476	65%
De Soto S Unit	570,652	204,481	369,293	65%
Holly Springs N Unit	450,531	315,637	134,900	30%
Holly Springs S Unit	69,412	48,630	20,776	30%
Homochitto	373,497	181,583	191,914	51%
Tombigbee N Unit	47,424	20,802	26,621	56%
Tombigbee S Unit	71,731	31,465	40,267	56%
Totals	2,316,510	1,147,366	1,173,687	51%

Source: NFsMS

The approximate 1.2 million acres of acquired lands located within the six Forests across Mississippi are diverse. Within these lands there are over 2,000 acres of lakes and ponds and 600 miles of streams that are open to the public for fishing. There are 14 wildlife management areas operated by Mississippi Department of Wildlife, Fisheries and Parks (MDWFP). The types of forests range from seasonally flooded bottomland hardwood in the Delta NF to gently rolling terrain covered by southern pine ridges in the De Soto NF.

The Bienville NF is located within parts of Scott, Newton, Jasper, and Smith counties and lies within parts of the upper Pearl River, Strong River, and upper Leaf River watersheds. The Delta NF is located within Sharkey and Issaquena Counties and lies within the Bogue Phalia River, Deer Creek – Steele Bayou, and Lower Yazoo River watersheds. (Note: The proclamation boundary for the Delta NF extends into Issaquena County; however, there are currently no NFS lands in Issaquena County.) The De Soto NF is located within Jones, Wayne, Pearl River, Stone, Harrison, Jackson, George, Greene, Perry, and Forrest counties and lies in the Leaf River, lower Chickasawhay River, Black and Red Creeks, and Pascagoula River watersheds. The Homochitto NF is located within Copiah, Jefferson, Adams, Lincoln, Franklin, Wilkinson, and Amite counties and lies within the Bayou Pierre, Homochitto River, Amite River, and Buffalo River watersheds. The Holly Springs NF is located within Yalobusha, Lafayette, Pontotoc, Union, Marshall, Benton, and Tippah counties and lies within the upper Hatchie River, Porters Creek, Wolf River, Tallahatchie River and Little Tallahatchie River above Sardis Dam, Yocona River above Enid Dam, and Yalobusha River above Grenada Dam watersheds. The Tombigbee NF is located within Pontotoc, Chickasaw, Oktibbeha, Choctaw, and Winston counties and lies within the Tibbee River, Noxubee River, and Yockanookany River and upper Pearl River watersheds.

1.4.1.1 Lands Excluded from Decisions

Lands excluded from the NFS availability decision are:

1. The private lands (non-NFS lands) within the proclamation boundaries of the six NFsMS (see Table 1).
2. The portion of NFS lands with 100 percent privately-owned mineral rights (outstanding or reserved mineral rights) as long as the mineral rights remain privately-owned. About 10 percent of the NFS lands administered by the NFsMS are subject to 100 percent privately-owned mineral rights.
3. The wilderness areas totaling 6,046 acres, being, 1) Black Creek Wilderness Area, 5,052 acres, and 2) Leaf Wilderness Area, 994 acres. Both wilderness areas are located in the De Soto NF, De Soto Ranger District. Wilderness lands are excluded from leasing decisions per Congressional mandate.

1.4.2 Temporal Scope

The land availability decisions apply to NFS lands with Federally-owned mineral rights. For any such lands not under Federal oil and gas lease on the date of the decision, the availability decision would be implemented immediately. For any such lands under Federal oil and gas leases on the date of the decision, the leasing decision would be implemented after the leases expire, terminate, or are relinquished. In other words, current oil and gas leases on the NFsMS would be managed under existing leases until leases expire, terminate or are relinquished, at which time the management of future leases issued by BLM would be based on the decision made as a result of this environmental analysis.

The leasing decisions do not apply to the portions of NFS lands with 100 percent privately-owned mineral rights (outstanding or reserved mineral rights) as long as the mineral rights remain privately-owned. If the Federal Government were to acquire any such private mineral rights, then these newly-acquired Federal mineral rights would be managed based on the decision made as a result of this environmental analysis.

1.4.3 Administrative Scope

The Federal oil and gas program has a two stage decision process: 1) authorize a lease, 2) authorize operations on a lease (authorize an Application for Permit to Drill (APD)). Each step requires environmental analysis, and in the case of NFS lands, each step requires decisions by the Forest Service and the BLM.

The Forest Service and the BLM decisions related to this Environmental Analysis (EA) are needed to determine NFS lands available for oil and gas leasing and that it is in the public interest to offer the lands for lease. This is the leasing stage or first stage of the two stage process. Before any operations can be conducted under a lease, the Forest Service and the BLM are required to review the proposed operations (i.e., an APD) and conduct a site-specific environmental analysis prior to authorizing ground-disturbing operations, including site specific design criteria, such as Forest Plan Standards and Guidelines, BMP's as appropriate.

1.5 CONNECTED AND CUMULATIVE ACTIONS

This analysis considers connected and cumulative actions. The analysis considers the lease operations (second stage of the process) that may result from the leasing (first stage of the process) and estimates the type and amount of post-leasing activity (wells, roads, pipelines) that is reasonably foreseeable for each alternative. The analysis also considers past and present activity. The authorization of a lease grants rights to explore for and develop oil and gas within the terms and stipulations of the lease. However, these lease operations cannot be implemented until: 1) the leaseholder submits an APD to the BLM, 2) the Forest Service and the BLM conduct a site-specific NEPA analysis, 3) the Forest Service approves the Surface Use Plan of Operations in the APD, and 4) the BLM approves the APD. These actions, as well as the oil and gas exploration and development conducted under the APD, are actions connected with the leasing decision to be made.

These foreseeable actions are considered in this environmental analysis from which the leasing decisions would be made. The decisions on the lands that would be available for leasing, and the subsequent decision authorizing specific lands for leasing, are based upon analysis of the environmental effects of the connected actions.

Connected actions are being considered under each alternative in this EA. In this context, connected actions include the post-leasing approval of APDs, Surface Use Plans of Operation, and issuance of Rights-of-Way authorizations for off-lease activities needed to support oil and gas exploration, development, and production on lease. These actions may authorize or result in other activities such as drilling, construction of production facilities, roads and pipelines as discussed in Reasonable Foreseeable Development Scenario (RFDS) (See Appendix C).

As previously stated, the process for issuance of these permits for connected actions requires completion of additional site-specific environmental analyses. Site-specific protective measures, (i.e., design criteria) are prescribed following receipt of the APD and during development of the Surface Use Plan of Operation (SUPO).

1.6 FOREST PLAN CONTEXT

Management of each administrative unit of NFS lands is governed by the Forest Plan. The Forest Plan provides long-range, integrated multiple-use management direction, for all natural resource management activities. Mineral resources management is emphasized along with all other forest resources.

The Forest Plan is utilized as a management tool for attainment of National and Agency strategic goals and objectives. One strategic agency goal is to provide and sustain benefits to the American people (USDA Forest Service Strategic Plan Fiscal Years 2007 – 2012; Goal 2). An objective for attaining this goal is to help meet energy resource needs. The Forest Plan addresses this agency-wide strategic objective by establishing direction to manage minerals development so as to optimize the use of these resources in a manner that contains suitable environmental safeguards. These safeguards are specified at both the leasing stage (through laws and regulations protecting the environment, Forest Plan environmental requirements, and where appropriate, lease stipulations) and the operations or site development stage (through site-specific protective measures in the APDs). The Forest Plan recognizes that demand is high for oil and gas, and provides for Federal oil and gas leasing on the NFsMS. Since Forest Plan approval in 1985, Federal oil and gas leasing has occurred

as part of Forest Plan implementation. All leases issued since 1985 are conditioned by the fact that the leased lands are NFS lands and that operations under the lease are subject to the Forest Plan requirements for environmental protection.

This environmental analysis evaluates alternative scenarios concerning oil and gas leasing in order to make the lands available for leasing decision and the specific lands leasing decision. The Forest Plan would be amended where needed to be consistent with these decisions.

1.7 DECISIONS TO BE MADE

The Forest Service and the BLM, Federal agencies with separate responsibilities for lands within NFsMS, cooperated in this environmental analysis for separate decisions to be made by each Agency. The BLM is a cooperating agency, and would adopt the analysis and issue its own decision. The Forest Service and the BLM would make the following decisions informed by the environmental analysis:

1. The Forest Service would decide which NFS lands on the NFsMS are administratively available for oil and gas leasing and under what lease stipulations (36 CFR 228.102 (d)).
2. The Forest Service would decide what specific lands to authorize the BLM to offer for lease, subject to Forest Service stipulations to be attached to leases issued by the BLM (36 CFR 228.102 (e)).
3. The Forest Service would amend the current Forest Plan where needed to be consistent with the above decisions.
4. Subsequently, in accordance with the 2006 Forest Service/BLM MOU developed under the Energy Policy Act of 2005, the BLM would adopt this environmental analysis and issue its own decision on whether to offer leases for specific lands authorized by the Forest Service.

Existing oil and gas leases on NFsMS are in effect on approximately 369,000 acres. Current leased lands are included in the analysis and decision so that when any existing lease expires or is no longer in effect, the decision has been made whether or not to offer those specific lands for lease again and, if so, with what stipulations.

The Forest Service and the BLM decisions apply to Federally-owned minerals. Current oil and gas leases on the NFsMS would be managed under existing leases until leases expire, terminate or are relinquished, at which time those areas would be managed based on the decision made as a result of this environmental analysis. The Forest Service and the BLM decisions do not apply to areas already withdrawn from leasing by Congress (i.e., Wilderness Areas) or to privately-owned mineral rights, including outstanding or reserved mineral rights underlying NFS land's surface.

1.8 THE ANALYSIS PROCESS

The decisions concerning Federal oil and gas leasing would be based on knowledge and consideration of the effects that oil and gas leasing could have on the lands and the natural resources for the NFsMS and the techniques (protection measures) by which those effects can be minimized and managed. To develop this knowledge and make these determinations, the Forest and

interdisciplinary (ID) team first analyzed maps of NFS lands surface features and resources contained in the NFsMS Geographical Information System (GIS) database.

The team compared the maps of surface features on the Forest with their knowledge of the effects of oil and gas drilling, development and production from other parts of the Forest or vicinity. The team used information from past oil and gas activity to estimate what the environmental effects of the Reasonable Foreseeable Development Scenario (RFDS)-projected post leasing activities would be if they occurred at various locations on the NFsMS.

The probable effects on NFS lands and resources were then compared with knowledge of the protective measures available through application of the Standard Lease Terms and Supplemental stipulations. The ID team then made a series of determinations for each alternative about which environmental effects would be satisfactorily mitigated through use of Standard Lease Terms and Supplemental stipulations. The overall environmental effects of each alternative were compared through an analysis based on the level of development predicted by the RFDS. Those effects are discussed in Chapter 3 of this Environmental Assessment (EA).

1.9 SCOPING AND PUBLIC INVOLVEMENT

On January 30, 2007, public scoping was initiated for this environmental analysis. The public was encouraged to submit scoping comments by March 5, 2007. Analysis of comments received was completed by Mississippi State University (MSU) for review by NFsMS. Twenty-four responses were received from the public and are included in the Project Record. The analysis by MSU identified 27 issues. The Forest Service reviewed the MSU analysis and agreed with the issues identified. Issues were further considered for the level of significance that they have on the Proposed Action, the analysis and whether or not they would suggest that additional alternatives need to be developed and considered.

1.10 ISSUES

Issues were identified based on comments from the public and the interdisciplinary (ID) team. An ID Team reviewed both internal and external comments to identify significant and non-significant (other) issues. This terminology reflects the language used by the Council on Environment Quality (CEQ) to identify significant issues that may drive alternative formulation, required resource protection measures, or focus the analysis process. The issues identified through scoping, and the significance of those issues are documented in Appendix A. Issues identified as significant for the analysis of the Proposed Action are also included in Appendix A.

1.10.1 Mineral Resources

- Oil and Gas Resource – There is a concern that the NFsMS, being the largest Federal land management base in Mississippi, is not implementing Congressional direction for Federal oil and gas leasing on NFS lands
- Indicators for this issue:
 - ✓ Number of acres leased

1.10.2 Soil Productivity – there is a concern that indirect effects of leasing will lead to soil erosion through drill site preparations and temporary access road construction.

- Indicators for this issue:
 - ✓ Acres of disturbance on soils with different erosion and compaction parameters

1.10.3 Water Resources

- Sedimentation – there is a concern that indirect effects of leasing will lead to soil disturbance through oil and gas drill site preparation, and causing sediment to enter streams affecting water quality.
- Drinking Water Supply – There is a concern that the indirect effect of drilling through ground water aquifers will contaminate drinking water resources.
- Aquatic Life – There is a concern that indirect effects of leasing will affect aquatic life through brine and oil leaks and spills.
- Indicators for this issue:
 - ✓ Acres of soil disturbance from drill site and access road construction
 - ✓ Monitoring water quality parameters on streams and aquifers
 - ✓ Sediment bed-load increase

1.10.4 Air

- Vehicular impact on roads – There is a concern that an indirect effect from leasing will cause increased vehicle traffic on non-paved roads causing increased dust particles in the air.
- Oil & Gas Production – There is a concern that an indirect effect from leasing will affect the air by the testing of new wells and emissions from ongoing production.
- Indicators for this issue:
 - ✓ Miles of road reconstruction
 - ✓ Number of new producing wells

1.10.5 Transportation System

- Road Density – There is a concern that as indirect effect of leasing will increase the road density throughout the forest
- Indicators for this issue:
 - ✓ Miles of new access road construction

1.10.6 Vegetation

- Forest Health – There is a concern that an indirect effect of leasing would affect vegetation by altering nutrient cycling through tree removal and removal of organic matter and duff layers on the forest floor.
- Forest Health – There is a concern that an indirect effect of leasing would alter vegetation through “edge effect”, causing alterations in the microclimate along these disturbed edges.
- Forest Health – There is a concern that non-native invasive species would be introduced into a habitat through indirect effect of leasing by construction of drill sites and access roads.
- Indicators for this issue:
 - ✓ Findings of Biological Evaluation

1.10.7 Wildlife

- Threatened, Endangered and Sensitive Species (TES) – There is a concern that an indirect effect of leasing will disturb the native ecosystems that exist and provide habitat needs for threatened and endangered species of the NFsMS.
- Management Indicator Species (MIS) – There is a concern that an indirect effect of leasing would affect habitat and population of the management indicator species (terrestrial and aquatic) selected to represent habitat types on the NF.
- Indicators for this issue:
 - ✓ Finding of the Biological Evaluation

1.10.8 Cultural Resources

- Artifacts, Historic Sites and Pre-Historic Sites – There is a concern that an indirect effect of leasing would harm sites or artifacts important in determining historic or prehistoric use of the area by human.
- Indicators for this issue:
 - ✓ Number of sensitive sites potentially eligible or eligible for listing on the NRHP that would be affected.

1.10.9 Recreational Opportunities

- Recreation – There is a concern that an indirect effect of leasing would affect recreational opportunities and use.
- Indicators for this issue:

- ✓ Effect of drilling and production facilities on activities of camping, day use, hunting
- ✓ Percent of increase/decrease visits at recreational areas

1.10.10 Military Training Areas

- Military Training Areas – There is a concern that an indirect effect of leasing will allow more exploration for oil and gas and drilling facilities that may interfere with military training.
- Indicators for this issue:
 - ✓ Volume of leased acreage in military training areas

1.10.11 Visual Resources

- Aesthetics – There is a concern that an indirect effect of leasing will cause drilling which may affect the visual beauty of the Forest
- Drilling and Production Facilities – There is a concern that the indirect effects of leasing will cause increased drilling and production facilities that may emit obnoxious noises and odors
- Indicators for this issue:
 - ✓ Volume of leased acreage
 - ✓ Acres by treatments of VQO classification.

1.10.12 Climate Change

- There is a concern that leasing activities may contribute to projected changes in climate.

1.10.13 Economic Effects

- Cost and Benefits – There is a concern about the cost and benefits of actions
- Economics – There is a concern about the direct effects of leasing and indirect effects of exploration will provide a source of revenue to local, state, and Federal governments
- Indicators for this issue:
 - ✓ Present Value of Lease Sale
 - ✓ Present Value of Production Royalties
 - ✓ Present Value of Exploration Investment with Associated Jobs

1.11 DESIGN CRITERIA

The Proposed Action would incorporate the following design criteria and all appropriate Forest Plan standards and guidelines.

Soil Productivity

Minimize Ground disturbing effects by:

- 1) properly locating activities (i.e. access may be provided on necessity rather than convenience);
 - a) use previous disturbed areas (access routes) as much as possible;
 - b) avoid sensitive soils or soils with severe limitations/hazards (i.e. steep or unstable slopes, hydric soils, etc.) as much as possible.
- 2) limit activities when soils are wet (i.e. access may be restricted during wet seasons or following rainfall events);
- 3) implement Best Management Practices on a site-specific basis:
 - a) limit the extent of surface disturbance as much as possible;
 - b) surface/harden heavily used access routes;
 - c) install water diversions (water bars, terraces, etc.) to control run-off;
 - d) install erosion curtains to protect water quality;
 - e) stock pile topsoil for reclamation;
 - f) re-vegetate bare soil (seed, mulch, fertilize, lime, etc.) to control erosion; and
 - g) install rip-rap and erosion control blankets for gully control and to stop stream head-cut.

Water Quality

- 1) Compliance with the Standard Lease Terms and Lease Stipulations
Standard Lease Terms allow the Forest Service to require facilities to be moved up to 200 meters. This provision would be utilized on a case-by-case basis after analysis indicates that resource damage can be eliminated or minimized by relocation.
- 2) Activities and operations must adhere to BMP's
 - a. Mississippi Forestry Commission BMPs (http://www.mfc.ms.gov/water_quality.htm)
 - b. Bureau of land Management BMPs
(http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas.html)

A buffer of at least 250 feet would be the minimum allowance permitted for surface occupancy within riparian, wetlands, and floodplains. This provision would be based on site-specific analysis rather than a standard operating procedure.

Vegetation

Control of non-native invasive species (NNIS)

Some of these species are aggressive in displacement of native species or dominating disturbed sites. Examples are:

- 1) kudzu
- 2) cogongrass

The Conditions of Approval attached to the APD will address site-specific protective measures prior to any ground disturbances or activity. To prevent the introduction and spread of non-native species onto the National Forest land, the Operator shall ensure that all equipment moved onto National Forest land is free of soil, seeds, vegetative matter of other debris that could contain or hold non-native species.

Ground disturbing effects can be minimized by :

- 1) locating activities and facilities, when possible, in areas that are least sensitive;
- 2) using existing roads, corridors, and openings to the extent possible; and
- 3) revegetating disturbed and abandoned areas with native species or non-invasive temporary cover.

Wildlife (TES & MIS)

A site specific Biological Evaluation (BE) accompanies each APD, determining the effect on species of concern and containing design measures to avoid negative impacts to these species. See Appendix D for the BE for this analysis.

Cultural Resources

Compliance with Section 106 of the National Historic Preservation Act (NHPA) requires site-specific survey prior to ground disturbing activities on Federal land.

Visual

The Conditions of Approval attached to the APD will address visual concerns prior to any ground disturbing activity.

Efforts to preserve sensitive viewpoints:

- 1) Restrict surface occupancy,
- 2) Promote rapid re-vegetation,
- 3) Planting vegetative screens,
- 4) Painting equipment,
- 5) Prudently locating roads and facilities.

CHAPTER 2

THE ALTERNATIVES CONSIDERED

2.1 INTRODUCTION

Alternatives were developed by the ID Team in response to significant issues presented in the Purpose and Need section in Chapter 1 of this document. In this chapter are found:

- A detailed description of the Proposed Action and the other alternatives analyzed,
- A comparison of how the alternatives achieve the purpose and need for the action,
- A comparison matrix of the actions proposed in each alternative.

2.2 ALTERNATIVES

2.2.1 Alternative 1 – No Action Alternative

Under this alternative, new leases of Federal oil and gas would be prohibited on the NFsMS. The Forest Service would make all lands on the NFsMS administratively unavailable for Federal oil and gas leasing and would not authorize any specific lands for Federal oil and gas leasing. The Forest Plan would be amended to reflect these decisions. As a result, the BLM would not offer Federal oil and gas leases on NFsMS.

Under this alternative, existing Federal oil and gas leases on the NFsMS would be managed under the existing leases terms and conditions until the leases expire, terminate or are relinquished, at which time the lands would not be available for leasing in the future. Oil and gas exploration and development of existing leases would continue, including any present and future oil and gas production, until the existing leases expire, terminate or are relinquished.

The Forest Service leasing decisions applies to Federally-owned minerals, and does not apply to privately-owned mineral rights (outstanding or reserved mineral rights) on NFS lands as long as the mineral rights remain privately-owned. If the Federal Government were to acquire any such private mineral rights that include oil and gas rights, then these newly-acquired Federal mineral rights would be administratively unavailable for Federal oil and gas leasing.

2.2.2 Alternative 2 – Lands Available for Leasing Alternative

Under this alternative, new leases of Federal oil and gas would be allowed on the NFsMS. The Forest Service would make all lands on the NFsMS administratively available for Federal oil and gas leasing except lands withdrawn from oil and gas leasing by law or regulation such as Congressionally-designated Wilderness Areas.

All leases for the lands made administratively available for Federal oil and gas leasing would be subject to the following stipulations (see Appendix B for stipulations and related maps):

- A Timing Stipulation restricting ground disturbing construction and drilling during the wet season from 11/30 thru 3/31 would be applied to all leases, when needed for site protection.
- A Controlled Surface Use Stipulation would be applied to all leases containing areas larger than a 40-acre legal subdivision of high erosion hazard, steep slopes, or high susceptibility to wetness. A Notice to Lessee would be applied to leases where the high erosion hazard, steep slopes, or high susceptibility to wetness are less than a 40-acre legal subdivision. Map locations for these areas are identified in Appendix B.
- A No Surface Occupancy Stipulation would be applied to leases of Special Areas containing research, botanical, zoological, archaeological, or scenic areas, like the following examples of existing or proposed Special Areas:

National Forest	Special Area
Bienville	Bienville Pines Scenic Area Harrell Prairie Botanical Area Proposed Singleton Prairie Botanical Area Proposed Nutmeg Hickory Research Natural Area (RNA)
Delta	Proposed Cypress Bayou Botanical Area Green Ash-Sugarberry RNA Overcup Oak-Water Hickory RNA Red Gum RNA Dowling Bayou Archaeological Site
De Soto	Proposed Laurel Oak RNA Tiger Creek Botanical Area Unmanaged Forty Scenic Area Proposed Glen's Pond Zoological Area Red Hills Botanical Area Proposed Ragland Hills RNA Paul B. Johnson State Park Proposed Railroad Creek Titi Botanical Area Proposed Little Florida Botanical Area Proposed Pitcher Plant Botanical Area Proposed Loblolly Bay RNA Black Creek Seed Orchard Erambert Seed Orchard Proposed Granny Creek Bay RNA Proposed Buttercup Flats Botanical Area Black Creek Corridor Black Creek Scenic River Harrison RNA Harrison Experimental Forest Proposed Wyatt Hills Botanical Area
Holly Springs	Tallahatchie Experimental Forest Proposed Lee Creek RNA

Proposed LA-6 Botanical Area C122S
Proposed LA-2 Botanical Area C117S17
USDA:NRCS Jamie L. Whitten Plant Materials Center

Homochitto Proposed Sandy Creek Botanical Area
Okhissa Lake and Recreation Area

Tombigbee Proposed Bogue Cully RNA
Noxubee Crest RNA
Proposed Shagbark Hickory Botanical Area
Proposed Choctaw #4 Botanical Area
Chuquatonchee Bluffs Botanical Area & RNA
Owl Creek Mounds Archaeological Site
Proposed Prairie Mound RNA

Map locations for Special Areas are also located in Appendix B.

In addition, a No Surface Occupancy Stipulation would be applied to leases on developed recreation sites, administrative sites, and military site Camp Keller and portions of military site Camp Shelby on the De Soto National Forest. Special stipulations would also be applied to leases on Camp Shelby (Appendix B).

In addition, a Lease Notice regarding protection of Threatened and Endangered Species, and a Lease Notice regarding protection of wetlands would be applied to all leases (Appendix B). A Lease Notice regarding a potential reservoir of 3,000 surface acres on the Bienville NF would be applied to leases in the portion of the potential reservoir.

Under this alternative, the Forest Service would make available for lease all lands with the exception of those within the Congressional Designated Wildernesses. The BLM would make a decision that it is in the public interest to offer for available lands for lease subject to the requirements identified above. The Forest Plan would be amended to reflect these decisions, if necessary.

Under this alternative, existing Federal oil and gas leases on the NFsMS would be managed under the existing leases terms and conditions until the leases expire, terminate or are relinquished, at which time the lands would be available for leasing subject to the stipulations identified above. Oil and gas exploration and development of existing leases would continue, including any present and future oil and gas production, until the existing leases expire, terminate or are relinquished, at which time the Forest Service would authorize the BLM to offer these areas as specific lands for Federal oil and gas leasing subject to the stipulations identified above.

The Forest Service leasing decisions applies to Federally-owned minerals, and does not apply to privately-owned mineral rights (outstanding or reserved mineral rights) on NFS lands as long as the mineral rights remain privately-owned. If the Federal Government were to acquire any such private mineral rights that include oil and gas rights, then these newly-acquired Federal mineral rights would be administratively available for Federal oil and gas leasing, and the Forest Service would authorize the BLM to offer these areas as specific lands for Federal oil and gas leasing subject to the stipulations identified above.

2.3 ALTERNATIVE CONSIDERED BUT ELIMINATED FROM FURTHER STUDY

An alternative considered but eliminated from detailed study would be the halting of oil and gas exploration and development on existing leases. Under this alternative, the Forest Service would not approve any surface use plan of operations for APDs on existing leases on NFsMS, and the BLM would not approve any APDs on existing leases on NFsMS. For existing leases with no operations, this alternative would prevent lease operations; the Federal Government would be abrogating the lease. For existing leases with some oil and gas operations, this alternative would prevent new lease operations in all areas of the lease; the Federal Government would be abrogating key provisions of the lease. A subset of this alternative could also be to shut down existing operations.

Based on past experience, the environmental effects associated with existing leases are manageable. Existing oil and gas operations are part of the Congressionally-mandated multiple-use mission of the Forest Service. Maintaining the flow of domestic energy supplies of oil and gas is of National interest. For the reasons above, halting existing lease operations is not considered a reasonable alternative.

2.4 ENVIRONMENTAL PROTECTION MEASURES COMMON TO ALL ALTERNATIVES

After a Federal oil and gas lease is issued, the Federal leaseholder cannot construct a road, drill a well or conduct ground-disturbing operations until the Federal Government reviews and approves plans for each proposed well and associated roads. Before ground-disturbing operations can occur, the leaseholder must submit an APD, including a Surface Use Plan of Operation (SUPO), for review and approval by the Federal Government (BLM and Forest Service). The Forest Service, in cooperation with the BLM, conducts a site-specific NEPA analysis of the proposed operation as required by the NEPA (1969). Alternatives, such as different access roads locations, are assessed to address issues. An ID team reviews the proposed operations and develops site-specific environmental protections that are applied to the APD. The environmental protections are derived from environmental protection laws and regulations applicable to NFS lands. Proposed lease operations are subject to environmental protection requirements in a wide range of laws and regulations, including Endangered Species Act, Archaeological Resources Protection Act, Federal Water Pollution Control Act, Clean Water Act, Clean Air Act, and all the other environmental protection laws and regulations applicable to NFS lands.

Proposed lease operations are subject to environmental protection requirements in 1) Forest Service regulations, including the 36 CFR 228E, regulations developed to implement Federal Onshore Oil and Gas Leasing Reform Act of 1987, 2) the Forest Plan. For example, the surface use requirements (36 CFR 228.108) require environmental protections relating to access facilities, cultural resources, fire prevention, fisheries, wildlife, plant habitat, threatened and endangered species, safety, wastes including drilling wastes, watershed protection including surface water and groundwater, erosion and sediment production, riparian areas and wetlands, and reclamation.

For example, soil losses would be reduced or minimized through the application of Best Management Practices (BMPs) on a site-specific basis. Examples of such practices include use of erosion curtains to protect drainages, surfacing roads, water bars and check dams to control run-off, stockpiling of topsoil for reclamation and revegetation, and use of rip-rap to control gully and head-cutting.

Other measures include appropriate engineering design of roads, well pads, and ancillary facilities; and avoidance of steep and/or unstable slopes and sensitive soils.

Effects on vegetation and other resources would be minimized by:

- 1.) locating activities and facilities, when possible, in areas that are least sensitive;
- 2.) using existing roads, corridors, and openings to the extent possible; and
- 3.) revegetating disturbed and abandoned areas with native species or non-invasive temporary cover.

To minimize the effects of ground disturbance, well sites and their associated roads and pipeline corridors, would be located in already disturbed areas whenever possible, preferably along existing roads, corridors and openings. Using already affected areas would not only decrease the direct effects to rare and native species, but would also decrease the potential introduction and spread of non-native invasive species (NNIS).

Riparian area, waterhole, wetland and pond/lake conditions of approval in APDs would protect aquatic habitats and aquatic management indicator species. Specific guidance for protection of wildlife and fisheries resources from effects due to oil and gas activities or other activities is discussed in the Forest Plan. Protection measures include locating facilities in areas that are already altered or largely fragmented; locating facilities along peripheries of large habitat patches rather than in interiors; minimizing area to edge ratios of access and well sites where they are located in or along large forest patches; using existing roads, corridors, and openings to the extent possible; revegetating disturbed and abandoned areas with native species or non-intrusive temporary cover and requiring timing limitations for seasonally sensitive species can help to minimize impacts of ground disturbance on wildlife and wildlife habitat.

Road gates and appropriate signs at key areas would be installed on leases with oil and gas operations to protect public safety and to avoid vandalism.

Protective measures for visual resources include restricting surface occupancy, promoting rapid revegetation, planting vegetative screens, painting equipment, and prudently locating roads and equipment. The protective measures would be developed and applied on a site-by-site basis.

In addition, proposed lease operations are subject to environmental protection requirements in the BLM regulations, oil and gas lease terms and conditions, Onshore Oil and Gas Order No. 1, and other onshore oil and gas orders, and Notice to Lessee issued pursuant to Federal regulations. For example, environmental protections in the standard oil and gas lease include requirements such as: “Conduct of Operations - Lessee shall conduct operations in a manner that minimizes adverse effects to the land, air, and water, to cultural, biological, visual, and other resources, and to accomplish the intent of this section. To the extent consistent with lease rights granted, such measures may include, but are not limited to, modification to siting or design of facilities, timing of operations, and specification of interim and final reclamation measures. Lessor reserves the right to continue existing uses and to authorize future uses upon or in the leased lands, including the approval of easements or rights-of-ways. Such uses shall be conditioned so as to prevent unnecessary or unreasonable interference with rights of Lessee.”

Standard Lease Terms and Federal regulations allow the Forest Service and the BLM to: 1) control surface use of proposed activities in the lease area, and 2) prohibit surface occupancy on some areas within the lease area. For example, a proposed oil and gas facility, such as a road, can be relocated up to 200 meters without any stipulation. In addition, under a Federal law such as the Endangered Species Act, the Forest Service at the APD stage can control or prohibit surface occupancy of any size acreage, when justified, without a lease stipulation.

The 200 meter provision would be utilized on a case-by-case basis after analysis indicates that resource damage can be eliminated or minimized by relocation. A buffer of at least 250 feet would be the minimum allowance permitted for surface occupancy within riparian, wetlands, and floodplains. Again, this provision would be based on site-specific analysis rather than a standard operating procedure. In addition, BMPs designed to protect soil productivity and water quality from loss due to erosion and mass wasting would be used as appropriate based on site-specific analysis.

The BLM BMPs applicable to oil and gas development are on the BLM website at:

http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/best_management_practices/technical_information.html.

The BLM Onshore Oil and Gas Orders and BMPs would be applied to environmental protections relating to groundwater, erosion control, hazardous material and waste management, and other environmental matters.

Future applications for exploration and drilling would require the preparation of a site-specific NEPA analysis and coordination with the State Historic Preservation Office (SHPO). If cultural resources are identified, their eligibility would be evaluated on a case-by-case basis. Operations would be relocated or restricted based on existing Federal regulations and policies to protect heritage resources.

Proposed lease operations are subject to the state laws and regulations governing oil and gas operations, including requirements for environmental protection and reclamation. The Mississippi State Board of Oil and Gas has law and regulation for environmental protection of oil and gas operations as part of state permitting of operations. State of Mississippi regulations require a Spill Prevention and Control Countermeasure Plan; the emergency spill response procedures to follow if an accidental spill of crude oil or brine is discharging, or threatens to discharge, into surface waters. The Mississippi Department of Environmental Quality (MDEQ) is to be notified and they would direct the oil and gas operator to complete remedial action for cleanup of soil and water resources and timely repair of damaged wells, pipelines or tanks.

Monitoring would be conducted by Federal and state agencies, including the Forest Service, the BLM, and the Mississippi State Board of Oil and Gas. At the APD (including Surface Use Plan of Operations) stage, when the operator is proposing ground-disturbing activities (roads, well pads, etc.) at specific locations, these proposals are monitored to insure consistency with the lease stipulations. Site-specific analysis would include environmental protection measures, as appropriate.

Monitoring would occur at several stages over the life of oil and gas operations on a Federal lease. They are as follows: 1) pre-construction meeting would be held before construction begins to monitor that the operator's field plans are in compliance with the approved APD; 2) on-site inspections are conducted of the construction activities (roads, well pads, etc.); 3) if exploration is unsuccessful, then reclamation would be inspected for compliance with the reclamation plan; 4) if exploration is successful, and the well site is developed for production, then the interim reclamation of the well pad would be inspected for compliance with the reclamation plan; 5) during the years that

a well is producing or lease is active, the access road, well site and associated facilities would be inspected for compliance with the APD (including SUPOs) including maintenance of facilities; and 6) when the well is to be abandoned and roads closed, the final reclamation would be monitored.

2.5 COMPARISON OF ALTERNATIVES

This section provides a summary of the important effects of implementing each alternative. Effects are those that define the issues, and act to provide a clear basis of choice between alternatives. Information in Table 2 displays activities, outputs, and area affected that can be distinguished quantitatively or qualitatively between the two alternatives. More discussion on activities, outputs, or effects can be found in Chapter 3 under the resource headings.

Table 2. Comparison of Alternatives

Activity, Output, or Effect	Alternative 1	Alternative 2
Acres available for future oil & gas leasing	0	Approx. 1.2 million (wilderness area excluded)
Acres available for oil & gas exploration & production	Approx. 369,000 (Acres currently leased) Temporary until leases expire, terminate, or are relinquished; then 0 acres available.	Approx. 1.2 million (wilderness area excluded)
Effects to Soils, Water, Vegetation, Wildlife, Cultural Resources, Special Areas, T&E Species and Visual Quality based on acres of surface disturbance for projected activity level	268 acres – low level 665 acres – most probable level 1,427 acres – high level	688 acres – low level 1,737 acres – most probable level 3,723 acres – high level
Effects to Soils, Water, Vegetation, Wildlife, Cultural Resources, Special Areas, T&E Species and Visual Quality based on percent of surface disturbance on NFsMS for maximum projected activity level	Less than one-seventh of one percent of surface disturbance on NFS lands	Less than one-third of one percent of surface disturbance on NFS lands
Effects on NFsMS generation of Federal oil and gas lease revenue and Mississippi's 25% share	Complete cessation of \$millions in bonuses and new rental revenue. Decline in production royalty not replaced by new production.	Continuation of \$millions in bonuses and new rental revenue. Opportunity for new production to offset decline in production royalty.
Effects on direct economic investment generated by Federal oil and gas leasing on NFsMS	\$116 million – low level \$226 million – most probable level \$336 million – high level	\$299 million – low level \$590 million – most probable level \$879 million – high level

Source: Summary of NFsMS estimates using BLM's RFD as base

This page intentionally left blank.

CHAPTER 3

ENVIRONMENTAL CONSEQUENCES

3.1 INTRODUCTION

Reasonably foreseeable actions consist of projects, actions, or developments that can be projected, with a reasonable degree of confidence, to occur within a defined time frame and that would impact the same environmental factors. Since establishment, farming, road construction, livestock grazing, recreation, oil and gas exploration and development, suburban development, and other uses have occurred in or adjacent to the NFsMS.

3.2 REASONABLE FORESEEABLE DEVELOPMENT SCENARIO (RFDS)

In order to analyze the environmental effects that could occur as a result of each alternative, projections of the kind and amount of oil and gas activity that could be reasonably anticipated were made. The regulations in 36 CFR 228.102 (c) (3 and 4), require this analysis to “project the type/amount of post-leasing activity that is reasonably foreseeable as a consequence of conducting a leasing program consistent with that described for each alternative” and “analyze the reasonable foreseeable impacts of post-leasing activity under (c)(3) of this section as a part of the analysis.” This post-leasing activity is the oil and gas activity (such as construction of roads, well pads, pipelines) that would be expected to be generated for each alternative. These are the activities that would generate physical/biological and social/economic effects.

The BLM, Eastern States Office, prepared a RFDS (October 14, 2005) for oil and gas development within the nine proclamation boundaries of the NFsMS using historical oil and gas development information, geologic information and interpretation, and projected market trends (Appendix C). The RFDS estimates what oil and gas exploration and development activity might occur on the NFsMS over a 15 year planning horizon.

The RFDS estimated that typically 2 to 5 acres would be cleared and graded level for construction of a well pad, depending on the topography. The RFDS estimated the access roads as generally 30 feet wide and average 1/3 mile in length. Drilling wells is 24- hour operation, when possible and usually takes approximately two weeks to one month to advance to depth. The RFDS estimates that 30 percent of the wells would be productive. If the drilling activities produce a viable well, the size of the pad would be reduced to approximately 10,000 square feet and pipeline right-of-way corridors would be constructed. The pipeline corridors are required to be less than 30 feet wide, and are placed in road right-of-ways or other corridors when possible.

Based on these assumptions, the RFDS estimated the surface disturbance of roads, well pads, and pipelines based on projected number of wells within the proclamation boundaries of the NFsMS over a 15 year period (see Revised Table 4 in Appendix C). Because the proclamation boundaries include private land as well as NFS land, the RFDS estimate of surface disturbance includes all land (private and NFS) within the proclamation boundaries. The RFDS estimated three levels of future oil and gas activity: a low level; a high level; and an anticipated level considered the most probable level. Based on these levels, the RFDS estimated, for the 15 year period, a cumulative effect in the range of 1,287

to 7,069 acres of surface disturbance, with an anticipated (most probable) level of activity disturbing a total of 3,285 acres (annual average of 219 acres). The maximum acres of surface disturbance projected (7,069 acres) as a result of a high level of oil and gas exploration and production activities is about 0.31 percent of the acres (Federal and non-Federal lands) within the NFsMS.

The RFDS provides a cumulative effect context and a basis for refining the RFDS to focus only on NFS lands within the proclamation boundaries. Thus the RFDS was further refined (below) to estimate the surface disturbance based on projected number of wells on NFS lands only, and then for each alternative.

The percentage of NFS land within the proclamation boundaries (see Table 1) was used as a basis to estimate the percentage of wells and surface disturbance on NFS lands within the proclamation boundaries shown on the BLM RFDS Revised Table 4, (see Appendix C). Within those proclamation boundaries where the refined BLM RFDS (see BLM Revised Table 4, Appendix C) was used, it estimated relatively few wells (25 or less), all the wells are assumed to be on NFS lands. The resulting estimation of surface disturbance on NFS lands is shown in Table 3.

Table 3. Estimation of Surface Disturbance Based Upon Projected Number of Wells on NFS Lands within Proclamation Boundary of NFsMS

National Forest	Projected Activity Level	# of Wells	Exploration Activity (Acres)								Production Activity (Acres)				Total Disturbance (Ac)		
			Access road	Well Pad (Acres)			Total Acres			# of Wells	Flow lines	Well Head	Total	Low	Avg	High	
				Lo 2ac	Av 3ac	Hi 5ac	Low	Avg	High								
Bienville	High	54	65	108	162	270	173	227	335	17	21	4	25	194	248	356	
	Anticipated	36	44	72	108	180	116	152	224	11	13	3	16	129	165	237	
	Low	18	22	36	54	90	58	76	112	6	7	1	9	65	83	119	
Delta	High	6	7	12	18	30	19	25	37	2	2	0.5	3	22	28	40	
	Anticipated	4	5	8	12	20	13	17	25	1	1	0.2	1	14	18	26	
	Low	2	2	4	6	10	6	8	12	1	1	0.2	1	8	10	14	
De Soto, N Unit	High	68	82	136	204	340	218	286	422	21	25	5	30	244	312	448	
	Anticipated	46	56	92	138	230	148	194	286	14	17	3	20	165	211	303	
	Low	23	28	46	69	115	74	97	143	7	8	2	10	82	105	151	
De Soto, S Unit	High	214	259	428	642	1070	687	901	1329	65	79	15	94	766	980	1408	
	Anticipated	142	172	284	426	710	456	598	882	43	52	10	62	508	650	934	
	Low	72	87	144	216	360	231	303	447	22	27	5	32	258	330	474	
Holly Springs, N Unit	High	6	7	12	18	30	19	25	37	2	2	0.5	3	22	28	40	
	Anticipated	5	6	10	15	25	16	21	31	2	2	0.5	3	18	23	33	
	Low	3	4	6	9	15	10	13	19	1	1	0.2	1	11	14	20	
Holly Springs, S Unit	High	4	5	8	12	20	13	17	25	1	1	0.2	1	14	18	26	
	Anticipated	3	4	6	9	15	10	13	19	1	1	0.2	1	11	14	20	
	Low	2	2	4	6	10	6	8	12	1	1	0.2	1	8	10	14	
Homochitto	High	250	303	500	750	1250	803	1053	1553	75	91	17	108	894	1144	1644	
	Anticipated	167	202	334	501	835	536	703	1037	51	62	12	74	598	765	1099	
	Low	84	102	168	252	420	270	354	522	26	32	6	37	301	385	553	
Tombigbee, N Unit	High	21	25	42	63	105	67	88	130	6	7	1	9	75	96	138	
	Anticipated	14	17	28	42	70	45	59	87	4	5	1	6	50	64	92	
	Low	7	8	14	21	35	22	29	43	2	2	0.5	3	25	32	46	
Tombigbee, S Unit	High	3	4	6	9	15	10	13	19	1	1	0.2	1	11	14	20	
	Anticipated	2	2	4	6	10	6	8	12	1	1	0.2	1	8	10	14	
	Low	1	1	2	3	5	3	4	6	0	0	0	0	3	4	6	
Totals	High	626	759	1252	1878	3130	2011	2637	3889	190	230	44	274	2241	2867	4119	
	Anticipated	419	508	838	1257	2095	1346	1765	2603	128	155	29	185	1501	1920	2758	
	Low	212	257	424	636	1060	681	893	1317	66	80	15	95	761	973	1397	

Note: Total Disturbance Acres equals the Exploration Activity Acres added to the Acres for the Flow lines.

Source: NFsMS estimates using BLM's RFD as base

The largest number of projected wells is on Bienville, De Soto-North (Chickasawhay Ranger District), De Soto-South (De Soto Ranger District), and the Homochitto Units of the NFsMS. Less oil and gas activity is projected for the Delta, Holly Springs North and South Units, and Tombigbee North and South Units.

The projected number of wells on NFS land (Table 3) can be divided into three groups:

- Group 1 - projected wells on existing Federal oil and gas leases on NFS lands.
- Group 2 - projected wells on potential future Federal oil and gas leases on NFS lands not currently leased.
- Group 3 - projected wells on privately-owned mineral rights (outstanding or reserved mineral rights) on NFS lands.

These three groups were used to refine the RFDS for the alternatives.

3.2.1 RFDS - Alternative 1 (No Action Alternative)

Under Alternative 1, new Federal oil and gas leases would not be allowed on the NFsMS. Existing Federal oil and gas leases on the NFsMS would be managed under the existing leases terms and conditions until the leases expire, terminate or are relinquished, at which time the lands would not be available for leasing. Oil and gas exploration and development of existing leases would continue until the existing leases expire, terminate or are relinquished. Thus, the RFDS for Alternative 1 includes Group 1 - projected wells on existing Federal oil and gas leases on NFS lands.

The percentage of existing Federal oil and gas leases on NFS land (Table 4) was used as a basis to estimate the percentage of projected wells and surface disturbance on NFS lands in Table 3 that is attributable to existing Federal oil and gas leases.

Table 4. Acres and Percent of Federal Oil and Gas Leases on NFsMS

National Forest	Acres NFS land in proclamation boundary	Total Acres of Federal leases on NFS land	Percent of NFS land with Federal lease
Bienville	178,542	78,904	44%
Delta	60,898	0	0%
De Soto N Unit	150,476	45,921	31%
De Soto S Unit	369,293	134,882	37%
Holly Springs N Unit	134,900	0	0%
Holly Springs S Unit	20,776	6,365	31%
Homochitto	191,914	59,693	31%
Tombigbee N Unit	26,621	16,496	62%
Tombigbee S Unit	40,267	27,069	67%
Totals	1,173,687	369,330	31%

Source: BLM statistics

The resulting estimate of surface disturbance based on projected number of wells for existing Federal oil and gas leases on NFS lands is shown in Table 5.

Table 5. Estimation of Surface Disturbance Based Upon Projected Number of Wells on Existing Federal Oil & Gas Leases on NFsMS – Alternative 1 (Indirect Effects)

National Forest	Projected Activity Level	# of Wells	Exploration Activity (Acres)							Production Activity (Acres)				Total Disturbance (Ac)		
			Access road	Well Pad (Acres)			Total Acres			# of Wells	Flow lines	Well Head	Total	Low	Avg	High
				Lo 2ac	Av 3ac	Hi 5ac	Low	Avg	High							
Bienville	High	24	29	48	72	120	77	101	149	7	8	2	10	86	110	158
	Anticipated	16	19	32	48	80	51	67	99	5	6	1	7	57	73	105
	Low	8	10	16	24	40	26	34	50	2	2	0.5	3	28	36	52
Delta	High	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Anticipated	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Low	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
De Soto, N Unit	High	20	24	40	60	100	64	84	124	6	7	1	9	72	92	132
	Anticipated	14	17	28	42	70	45	59	87	4	5	1	6	50	64	92
	Low	7	8	14	21	35	22	29	43	2	2	0.5	3	25	32	46
De Soto, S Unit	High	78	95	156	234	390	251	329	485	23	28	5	33	278	356	512
	Anticipated	52	63	104	156	260	167	219	323	16	19	4	23	186	238	342
	Low	27	33	54	81	135	87	114	168	8	10	2	12	96	123	177
Holly Springs, N Unit	High	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Anticipated	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Low	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Holly Springs, S Unit	High	1	1	2	3	5	3	4	6	1	1	0.2	1	4	5	7
	Anticipated	1	1	2	3	5	3	4	6	1	1	0.2	1	4	5	7
	Low	1	1	2	3	5	3	4	6	1	1	0.2	1	4	5	7
Homochitto	High	78	95	156	234	390	251	329	485	23	28	5	33	278	356	512
	Anticipated	52	63	104	156	260	167	219	323	16	19	4	23	186	238	342
	Low	26	32	52	78	130	84	110	162	8	10	2	12	93	119	171
Tombigbee, N Unit	High	14	17	28	42	70	45	59	87	4	5	1	6	50	64	92
	Anticipated	9	11	18	27	45	29	38	56	2	2	0.5	3	31	40	58
	Low	5	6	10	15	25	16	21	31	1	1	0.2	1	17	22	32
Tombigbee, S Unit	High	2	2	4	6	10	6	8	12	1	1	0.2	1	8	10	14
	Anticipated	1	1	2	3	5	3	4	6	1	1	0.2	1	4	5	7
	Low	1	1	2	3	5	3	4	6	0	0	0	0	3	4	6
Totals	High	217	263	434	651	1085	697	914	1348	65	79	15	94	776	993	1427
	Anticipated	145	176	290	435	725	466	611	901	45	55	10	65	520	665	955
	Low	75	91	150	225	375	241	316	466	22	27	5	32	268	343	493

Note: Total Disturbance Acres equals the Exploration Activity Acres added to the Acres for the Flow lines.

Source: NFsMS estimates using BLM's RFD as base

Under Alternative 1, depending on the projected level of oil and gas activity, the RFDS for existing leases estimates for the 15 year period, a cumulative effect in the range of 268 to 1,427 acres of surface disturbance (an annual average in the range of 18 to 95 acres and 5 to 14 wells per year). The most probable level of activity is estimated to disturb about 665 acres (an annual average of 44 acres and 10 wells per year). The cumulative effects acres of surface disturbance projected for each activity level for Alternative 1 is less than one-seventh of one percent of the NFS lands on the NFsMS.

3.2.2 RFDS - Alternative 2 (Lands Available for Leasing Alternative)

Under Alternative 2, new leases of Federal oil and gas would be allowed on the NFsMS. Several hundred thousand acres of NFS lands not currently leased would be made administratively available for leasing, and the Forest Service would authorize these specific lands for leasing. Oil and gas exploration and development would occur on the new leases as well as the existing leases. Under Alternative 2, all the areas currently under lease would also be administratively available, and the

Forest Service would authorize these specific lands for leasing when any current lease expires or is no longer in effect.

The percentage of NFS land currently not in Federal leases (Table 6) was used as a basis to estimate the percentage of projected wells and surface disturbance on NFS lands in Table 3 that is attributable to potential future Federal oil and gas leases on NFS lands not currently leased. The resulting estimate of surface disturbance is shown in Table 7.

Table 6. Acres and Percent of NFS Lands Not Currently in Federal Oil & Gas Lease on NFsMS

National Forest	Acres NFS land in proclamation boundary	Acres of Federal minerals not currently in Federal lease	Percent of NFS land not currently in Federal lease
Bienville	178,542	90,738	51%
Delta	60,898	57,798	95%
De Soto N Unit	150,476	90,690	60%
De Soto S Unit	369,293	210,365*	57%
Holly Springs N Unit	134,900	124,600	92%
Holly Springs S Unit	20,776	14,011	67%
Homochitto	191,914	103,721*	54%
Tombigbee N Unit	26,621	9,125	34%
Tombigbee S Unit	40,267	11,298	28%
Totals	1,173,687	712,346	61%
*Excludes 5,996 acres in Black Creek Wilderness Area (5,052 acres), Leaf Wilderness Areas (944 acres).			

Source: BLM statistics

Table 7. Estimation of Surface Disturbance Based Upon Projected Number of Wells on Future Federal Oil & Gas Leases on NFsMS

National Forest	Projected Activity Level	# of Wells	Exploration Activity (Acres)							Production Activity (Acres)				Total Disturbance (Ac)		
			Access road	Well Pad (Acres)			Total Acres			# of Wells	Flow lines	Well Head	Total	Low	Avg	High
				Lo 2ac	Av 3ac	Hi 5ac	Low	Avg	High							
Bienville	High	28	34	56	84	140	90	118	174	8	10	2	12	100	128	184
	Anticipated	18	22	36	54	90	58	76	112	5	6	1	7	64	82	118
	Low	9	11	18	27	45	29	38	56	3	4	1	4	33	42	60
Delta	High	6	7	12	18	30	19	25	37	2	2	0.5	3	22	28	40
	Anticipated	4	5	8	12	20	13	17	25	1	1	0.2	1	14	18	26
	Low	2	2	4	6	10	6	8	12	1	1	0.2	1	8	10	14
De Soto, N Unit	High	41	50	82	123	205	132	173	255	12	15	3	17	146	187	269
	Anticipated	28	34	56	84	140	90	118	174	8	10	2	12	100	128	184
	Low	14	17	28	42	70	45	59	87	4	5	1	6	50	64	92
De Soto, S Unit	High	122	148	244	366	610	392	514	758	37	45	8	53	437	559	803
	Anticipated	81	98	162	243	405	260	341	503	24	29	6	35	289	370	532
	Low	41	50	82	123	205	132	173	255	12	15	3	17	146	187	269
Holly Springs, N Unit	High	6	7	12	18	30	19	25	37	2	2	0.5	3	22	28	40
	Anticipated	5	6	10	15	25	16	21	31	2	2	0.5	3	18	23	33
	Low	3	4	6	9	15	10	13	19	1	1	0.2	1	11	14	20
Holly Springs, S Unit	High	3	4	6	9	15	10	13	19	1	1	0.2	1	11	14	20
	Anticipated	2	2	4	6	10	6	8	12	1	1	0.2	1	8	10	14
	Low	1	1	2	3	5	3	4	6	1	1	0.2	1	4	5	7
Homochitto	High	135	164	270	405	675	434	569	839	41	50	9	59	483	618	888
	Anticipated	90	109	180	270	450	289	379	559	27	33	6	39	322	412	592
	Low	45	55	90	135	225	145	190	280	14	17	3	20	162	207	297
Tombigbee, N Unit	High	7	8	14	21	35	22	29	43	2	2	0.5	3	25	32	46
	Anticipated	5	6	10	15	25	16	21	31	2	2	0.5	3	18	23	33
	Low	2	2	4	6	10	6	8	12	1	1	0.2	1	8	10	14
Tombigbee, S Unit	High	1	1	2	3	5	3	4	6	1	1	0.2	1	4	5	7
	Anticipated	1	1	2	3	5	3	4	6	1	1	0.2	1	4	5	7
	Low	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	High	349	423	698	1047	1745	1121	1470	2168	106	128	24	153	1250	1599	2297
	Anticipated	234	284	468	702	1170	752	986	1454	71	86	16	102	838	1072	1540
	Low	117	142	234	351	585	376	493	727	37	45	8	53	421	538	772

Note: Total Disturbance Acres equals the Exploration Activity Acres added to the Acres for the Flow lines.

Source: NFsMS estimates using BLM's RFD as base

Under Alternative 2, depending on the level of oil and gas activity, the RFDS for new leases estimates for the 15 year period, a cumulative effect in the range of 421 to 2,297 acres of surface disturbance (an annual average in the range of 28 to 153 acres and 8 to 23 wells per year). The most probable level of activity is estimated to disturb about 1,072 acres (an annual average of 71 acres and 16 wells per year). The cumulative effects acres of surface disturbance projected for each activity level for this part of Alternative 2 is less than one-quarter of one percent of the NFS lands on the NFsMS.

Alternative 2 also would include the effects from existing leases (Alternative 1). Thus Alternative 2 consists of the projected wells and associated surface disturbance for existing leases (Table 5) and future leases (Table 7). The combined projected wells and associated surface disturbance for Alternative 2 is shown in Table 8. The RFDS for existing leases and new leases estimates for the 15 year period, a cumulative effect in the range of 688 to 3,723 acres of surface disturbance (an annual average in the range of 46 to 248 acres and 13 to 38 wells per year). The most probable level of activity is estimated to disturb about 1,737 acres (an annual average of 116 acres and 25 wells per year). The cumulative effects acres of surface disturbance projected for each activity level for Alternative 2 is less than one-third of one percent of the NFS lands on the NFsMS.

Table 8. Estimation of Surface Disturbance Based Upon Projected Number of Wells on Existing and Future Federal Oil and Gas Leases on NFsMS - Alternative 2 Total

National Forest	Projected Activity Level	# of Wells	Exploration Activity (Acres)							Production Activity (Acres)				Total Disturbance (Ac)		
			Access road	Well Pad (Acres)			Total Acres			# of Wells	Flow lines	Well Head	Total	Low	Avg	High
Bienville	High	52	63	104	156	260	167	219	323	15	18	3	22	185	237	341
	Anticipated	34	41	68	102	170	109	143	211	10	12	2	14	121	155	223
	Low	17	21	34	51	85	55	72	106	5	6	1	7	61	78	112
Delta	High	6	7	12	18	30	19	25	37	2	2	0.5	3	22	28	40
	Anticipated	4	5	8	12	20	13	17	25	1	1	0.2	1	14	18	26
	Low	2	2	4	6	10	6	8	12	1	1	0.2	1	8	10	14
De Soto, N Unit	High	61	74	122	183	305	196	257	379	18	22	4	26	218	279	401
	Anticipated	42	51	84	126	210	135	177	261	12	15	3	17	149	191	275
	Low	21	25	42	63	105	67	88	130	6	7	1	9	75	96	138
De Soto, S Unit	High	200	242	400	600	1000	642	842	1242	60	73	14	87	715	915	1315
	Anticipated	133	161	266	399	665	427	560	826	40	48	9	58	476	609	875
	Low	68	82	136	204	340	218	286	422	20	24	5	29	243	311	447
Holly Springs, N Unit	High	6	7	12	18	30	19	25	37	2	2	0.5	3	22	28	40
	Anticipated	5	6	10	15	25	16	21	31	2	2	0.5	3	18	23	33
	Low	3	4	6	9	15	10	13	19	1	1	0	1	11	14	20
Holly Springs, S Unit	High	4	5	8	12	20	13	17	25	2	2	0.5	3	15	19	27
	Anticipated	3	4	6	9	15	10	13	19	2	2	0.5	3	12	15	21
	Low	2	2	4	6	10	6	8	12	2	2	0.5	3	9	11	15
Homochitto	High	213	258	426	639	1065	684	897	1323	64	78	15	92	762	975	1401
	Anticipated	142	172	284	426	710	456	598	882	43	52	10	62	508	650	934
	Low	71	86	142	213	355	228	299	441	22	27	5	32	255	326	468
Tombigbee, N Unit	High	21	25	42	63	105	67	88	130	6	7	1	9	75	96	138
	Anticipated	14	17	28	42	70	45	59	87	4	5	1	6	50	64	92
	Low	7	8	14	21	35	22	29	43	2	2	0.5	3	25	32	46
Tombigbee, S Unit	High	3	4	6	9	15	10	13	19	2	2	0.5	3	12	15	21
	Anticipated	2	2	4	6	10	6	8	12	2	2	0.5	3	9	11	15
	Low	1	1	2	3	5	3	4	6	0	0	0	0	3	4	6
Totals	High	566	686	1132	1698	2830	1818	2384	3516	171	207	39	247	2025	2591	3723
	Anticipated	379	459	758	1137	1895	1217	1596	2354	116	141	27	167	1358	1737	2495
	Low	192	233	384	576	960	617	809	1193	59	72	14	85	688	880	1264

Note: Total Disturbance Acres equals the Exploration Activity Acres added to the Acres for the Flow lines.

Source: NFsMS estimates using BLM's RFD as base

3.2.3 RFDS - Life Expectancy of Oil and Gas Wells and Operations

The RFDS estimates the number of wells to be drilled over a 15 year period on the NFsMS. The projected number of wells (which includes exploration as well as development of wells) is shown in the 3rd column (# of wells) in Tables 3, 5, 7 and 8. The RFDS estimates that 30 percent of the wells drilled on the NFsMS would be productive; the projected number of productive wells is shown in the 11th column (# of wells under Production Activity) in Tables 3, 5, 7 and 8. As a result, 70 percent of the wells to be drilled on the NFsMS (3rd column) are expected to be short duration operations (exploration only), lasting only a few months from start to finish (access road and drill pad construction; drilling; and reclamation).

The 30 percent of the wells drilled on the NFsMS that would be productive are longer duration operations than the 70 percent of wells drilled that are unsuccessful and do not go into production. The life expectancy of producing oil and gas wells can vary considerably. Factors that influence longevity are both direct and indirect. Direct factors include the producing formation, relative position within a producing field, timing of production compared to field life, and completion techniques. Indirect factors include economic influences such as those pertaining to an individual well, the individual or company that owns the well, market prices for oil and gas, and proximity to infrastructure. Some statistics were analyzed for producing wells in Mississippi

and are presented in the Table 9. Of the nearly 12,400 wells sampled across the entire state, 2,400 (19 percent) lacked sufficient data in the well report to complete the necessary calculation. Long and short lived wells occur across the state.

Table 9. Production Duration for 10,038 Oil and Gas Wells in Mississippi

Year Range		# of Wells	%
0-9.99	1st 10yrs	5,810	58%
10-19.99	2nd 10yrs	1,900	19%
20-29.99	3rd 10yrs	1,120	11%
30-39.99	4th 10yrs	621	6%
40-49.99	5th 10yrs	299	3%
50-99.99	2nd 50yrs	288	3%
	Total	10,038	100%
Longest Duration		67.5 yrs	

Source: BLM analysis of production duration for 10,038 oil and gas wells in Mississippi.

The duration of production wells in the RFDS for NFsMS is assumed to be similar to the duration of production for Mississippi wells (Table 9). The production wells would be considered long-term operations whose duration would be generally similar to the distribution of durations in Table 9, with about 88 percent of operations lasting less than 30 years, and about 12 percent of operations lasting longer than 30 years. The long-term operations (30 percent productive wells) and short term operations (70 percent non-productive wells) for each alternative are shown in Table 10.

3.2.4 RFDS Common to All Alternatives: Private Minerals on NFS lands

Decisions about alternatives on Federal oil and gas leasing apply to Federally-owned mineral rights, and do not apply to privately-owned mineral rights (outstanding or reserved mineral rights) on NFS lands. Oil and gas exploration and development would continue on private minerals on NFS lands regardless of which alternative is chosen. The acres and percentage of outstanding or reserved mineral rights on NFsMS is shown in Table 11.

Table 10. Projected Number of Productive & Non-Productive Federal Oil and Gas Wells to be Drilled on NFsMS by Alternative

National Forest	Projected Activity Level	Non-productive wells - short-term activity			Productive Wells - long-term activity		
		Existing leases Alternative 1 (projected wells)	Future leases - part of Alternative 2 (projected wells)	Existing & Future Leases - Alternative 2 total (projected wells)	Existing leases Alternative 1 (projected wells)	Future leases - part of Alternative 2 (projected wells)	Existing & Future Leases - Alternative 2 total (projected wells)
Bienville	High	17	20	37	7	8	15
	Anticipated	11	13	24	5	5	10
	Low	6	6	12	2	3	5
Delta	High	0	4	4	0	2	2
	Anticipated	0	3	3	0	1	1
	Low	0	1	1	0	1	1
De Soto, N Unit	High	14	29	43	6	12	18
	Anticipated	10	20	30	4	8	12
	Low	5	10	15	2	4	6
De Soto, S Unit	High	55	85	140	23	37	60
	Anticipated	36	57	93	16	24	40
	Low	19	29	48	8	12	20
Holly Springs, N Unit	High	0	4	4	0	2	2
	Anticipated	0	3	3	0	2	2
	Low	0	2	2	0	1	1
Holly Springs, S Unit	High	0	2	2	1	1	2
	Anticipated	0	1	1	1	1	2
	Low	0	0	0	1	1	2
Homochitto	High	55	94	149	23	41	64
	Anticipated	36	63	99	16	27	43
	Low	18	31	49	8	14	22
Tombigbee, N Unit	High	10	5	15	4	2	6
	Anticipated	7	3	10	2	2	4
	Low	4	1	5	1	1	2
Tombigbee, S Unit	High	1	0	1	1	1	2
	Anticipated	0	0	0	1	1	2
	Low	1	0	1	0	0	0
Totals	High	152	243	395	65	106	171
	Anticipated	100	163	263	45	71	116
	Low	53	80	133	22	37	59

Source: BLM statistics

Table 11. Acres and Percent of Private Mineral Rights on NFsMS

National Forest	Acres NFS land in proclamation boundary	Acres of outstanding or reserved mineral rights on NFS land	Percent of outstanding or reserved mineral rights on NFS land
Bienville	178,542	8,900	5%
Delta	60,898	3,100	5%
De Soto N Unit	150,476	14,500	10%
De Soto S Unit	369,293	18,000	5%
Holly Springs N Unit	134,900	10,300	8%
Holly Springs S Unit	20,776	400	2%
Homochitto	191,914	28,500	15%
Tombigbee N Unit	26,621	1,000	4%
Tombigbee S Unit	40,267	1,900	5%
Totals	1,173,687	86,600	7%

Source: BLM statistics

Based on existing oil and gas activity, the RFDS assumes that future activity on privately-owned mineral rights (outstanding or reserved mineral rights) would be on the Bienville, De Soto-North (Chickasawhay Ranger District), De Soto-South (De Soto Ranger District), and Homochitto Units of the NFsMS. The projected number of private wells is estimated to be the difference between the projected number of Federal wells (Table 8) and the projected numbers of wells on the NFsMS (Table 3). The projected number of private wells and the estimation of surface disturbance are shown in Table 12.

Under all alternatives, depending on the level of oil and gas activity, the RFDS for private wells estimates for the 15 year period, a cumulative effect in the range of 74 to 398 acres (an annual average in the range of 5 to 27 acres and 1 to 4 wells per year). The most probable level of activity is estimated to disturb about 185 acres (an annual average of 12 acres and 3 wells per year). The cumulative effects acres of surface disturbance projected for each activity level for private wells is less than one-twentieth of one percent of the NFS lands on the NFsMS.

3.3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

3.3.1 MINERAL RESOURCES

3.3.1.1 Current Condition

Oil and gas exploration and development has been part of the multiple-use management of the NFsMS for decades. In 1976, an Environmental Analysis Report evaluated oil and gas leasing on the NFsMS. In 1985, the Forest Plan and FEIS were developed with oil and gas leasing, exploration and development as part of the multiple-use management of the NFsMS. As a result, oil and gas exploration and development under Federal leases is part of the current condition. Most of the past and present oil and gas exploration and development on the NFsMS have been on the Homochitto NF and De Soto NF. The BLM, Eastern States Office, provides more information on the past and present oil and gas exploration and development on the NFsMS in the RFDS (Appendix C).

Table 12. Estimation of Surface Disturbance Based Upon Projected Number of Private Wells on NFsMS

National Forest	Projected Activity Level	# of Wells	Exploration Activity (Acres)							Production Activity (Acres)				Total Disturbance (Ac)		
			Access road	Well Pad (Acres)			Total Acres			# of Wells	Flow lines	Well Head	Total	Low	Avg	High
				Lo 2ac	Av 3ac	Hi 5ac	Low	Avg	High							
Bienville	High	2	2	4	6	10	6	8	12	2	2	0	3	9	11	15
	Anticipated	2	2	4	6	10	6	8	12	1	1	0	1	8	10	14
	Low	1	1	2	3	5	3	4	6	1	1	0	1	4	5	7
Delta	High	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Anticipated	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Low	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
De Soto, N Unit	High	7	8	14	21	35	22	29	43	3	4	1	4	26	33	47
	Anticipated	4	5	8	12	20	13	17	25	2	2	0	3	15	19	27
	Low	2	2	4	6	10	6	8	12	1	1	0	1	8	10	14
De Soto, S Unit	High	14	17	28	42	70	45	59	87	5	6	1	7	51	65	93
	Anticipated	9	11	18	27	45	29	38	56	3	4	1	4	33	42	60
	Low	4	5	8	12	20	13	17	25	2	2	0	3	15	19	27
Holly Springs, N Unit	High	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Anticipated	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Low	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Holly Springs, S Unit	High	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Anticipated	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Low	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Homochitto	High	37	45	74	111	185	119	156	230	11	13	3	16	132	169	243
	Anticipated	25	30	50	75	125	80	105	155	8	10	2	12	90	115	165
	Low	13	16	26	39	65	42	55	81	4	5	1	6	47	60	86
Tombigbee, N Unit	High	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Anticipated	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Low	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tombigbee, S Unit	High	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Anticipated	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Low	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	High	60	73	120	180	300	193	253	373	21	25	5	30	218	278	398
	Anticipated	40	48	80	120	200	128	168	248	14	17	3	20	145	185	265
	Low	20	24	40	60	100	64	84	124	8	10	2	12	74	94	134

Note: Total Disturbance Acres equals the Exploration Activity Acres added to the Acres for the Flow lines.

Source: NFsMS estimates using BLM's RFD as base

The current conditions regarding Federal oil and gas leasing are shown in Table 13. Approximately 1/3 of the Federal mineral estate on the NFsMS is currently leased. The disturbed acreage for existing Federal wells (Table 13) is based on typical conditions as developed by the BLM in the RFDS using historical data such as: 1) 1.2 acres for access road; 2) 1.2 acres for pipeline corridor; 3) 0.23 acre (about 10,000 square feet for a production pad), for a total of approximately 2.63 acres for each well associated with production.

In terms of mineral resources on Federal lands in Mississippi helping to meet oil and gas demands, the NFsMS has demonstrated interest in production of oil and gas and is a known potential for oil and gas development.

The NFsMS occupy approximately 1.2 million acres of the 1.8 million acres of Federal lands in MS. As the largest Federal land management base in Mississippi, as a demonstrated producer of Federal oil and gas, and as a Federal agency with a Congressionally-designated multiple-use mission, the NFsMS have strategic importance for Federal oil and gas resources in Mississippi.

Table 13. Current Condition - Federal Oil and Gas Leases on NFsMS

National Forest	Acres NFS land in proclamation boundary	Total Acres of federal leases on NFS land	Acres of federal leases held by production on NFS land	# of wells on federal leases	Acres of existing surface disturbance associated with existing federal wells
Bienville	178,542	78,904	1,989	3	8
Delta	60,898	0	0	0	0
De Soto N Unit	150,476	45,286	6,927	19	50
De Soto S Unit	369,293	134,882	7,949	19	50
Holly Springs N Unit	134,900	0	0	0	0
Holly Springs S Unit	20,776	6,365	0	0	0
Homochitto	191,914	59,693	19,292	82	216
Tombigbee N Unit	26,621	16,496	1,974	5	13
Tombigbee S Unit	40,267	27,069	0	0	0
Totals	1,173,687	368,695	38,131	128	337

Source: BLM statistics

3.3.1.2 Environmental Effects - Alternative 1 – No Action

Prohibiting new Federal oil and gas leases on the NFsMS would immediately eliminate opportunities for oil and gas exploration and development on 2/3 of Federal mineral estate on NFsMS not currently leased (about 712,000 acres). Oil and gas exploration and development of existing leases on 1/3 of Federal mineral estate on NFsMS (about 369,000 acres) would continue until the existing leases expire, terminate or are relinquished; once a lease is no longer in effect, the lands would not be leased again.

Because oil and gas exploration drilling would be prohibited on most of the Forest, this alternative would adversely affect the inventory and assessment of Federal energy and non-energy mineral resources on the NFsMS, which is the largest Federal land base in Mississippi. The immediate elimination of opportunities to explore and develop on 2/3 of NFsMS may also adversely affect the economic viability of future oil and gas operations on adjacent portions of 1/3 of NFsMS leased lands or on adjacent private lands.

Other effects could be difficulty in protecting Federal oil and gas resources from drainage onto private land. Compensation for drainage of Federal oil and gas wells on adjacent private mineral rights may be collected by the BLM after leasing the Federal tract. The Lessee can either drill the tract to protect the Federal acreage from drainage or pay the Mineral Management Service (MMS) compensatory royalty. If the BLM is unable to lease the Federal tract due to a no leasing policy or if the Lessee can not economically develop the tract, the BLM is unable to collect any royalties and the Federal oil and gas resource is "lost" to drainage. Federal land-use decisions such as "no surface occupancy" or "no leasing" may adversely affect the economics of developing a given well or tract.

In terms of meeting the Purpose and Need, Alternative 1 has adverse cumulative effects because it immediately eliminates opportunities for oil and gas exploration and development on the 2/3 of

Federal mineral estate on NFsMS not currently leased, and over time would eliminate opportunities for oil and gas exploration and development on the 1/3 of Federal mineral estate on NFsMS currently leased when those leases are no longer in effect. Alternative 1 would adversely affect long-term opportunities for new exploration targets and potential new discoveries and development activities to meet the Purpose and Need.

3.3.1.3 Environmental Effects - Alternative 2 – Consent to Leasing

Allowing new leases for Federal oil and gas on NFsMS increases opportunities for oil and gas exploration and development on the 2/3 of Federal mineral estate on NFsMS not currently leased (about 712,000 acres). Oil and gas exploration and development of existing leases on 1/3 of Federal mineral estate on NFsMS (about 369,000 acres) would continue until the existing leases expire, terminate or are relinquished; once a lease is no longer in effect, the Forest Service would authorize the BLM to offer these lands for Federal oil and gas leasing again.

This alternative would provide the maximum opportunity for inventory and assessment of Federal energy and non-energy mineral resources on the NFsMS, which is the largest Federal land base in Mississippi. Providing opportunities to explore and develop on 2/3 of NFsMS not currently leased may also improve the economic viability of future oil and gas operations on adjacent portions of 1/3 of NFsMS leased lands or on adjacent private lands.

Other effects include better ability to protect Federal oil and gas resources from drainage onto private land. An active Federal leasing program allows Federal exploration and development, and thus, can avoid drainage issues. In those cases where tracts become subject to drainage, leases would be offered that have protective drilling or compensation for drainage required by the Lessee.

In terms of meeting the Purpose and Need, Alternative 2 would have favorable cumulative effects because it immediately provides opportunities for oil and gas exploration and development on the 2/3 of Federal mineral estate on NFsMS not currently leased; and when the current leases on the 1/3 of Federal mineral estate on NFsMS are no longer in effect, the Forest Service would authorize the BLM to offer these lands for Federal oil and gas leasing again. Alternative 2 would have favorable effects on long-term opportunities for new exploration targets and potential new discoveries and development activities to meet the Purpose and Need.

3.3.2 SOIL PRODUCTIVITY

Sensitive soils may occur within watersheds where oil and gas leases are currently in effect or projected in the future. Watershed sensitivity is characterized as having erosive soils, land instability, slope steepness, and municipal water supply drainage. Similar to protected water resources, hydric soil areas (i.e., floodplains, riparian areas, and wetlands) are protected under Federal Executive Orders 11988 and 11990, respectively.

3.3.2.1 Current Condition

The NFsMS is broadly classified as primarily within East Gulf Coastal Plain Physiographic Region. The exception to this would be the Delta National Forest which lies within the Mississippi Alluvial Plain Physiographic Region. Areas with similar climate, surface geology, soils, topography, vegetation, and geologic history have been grouped into 10 distinct physiographic provinces (Stewart, 2003). With the exception of the Tombigbee Hills, all the Physiographic Provinces of

Mississippi are represented on lands managed by the NFsMS. Mississippi's Physiographic Provinces are shown on Figure 2.

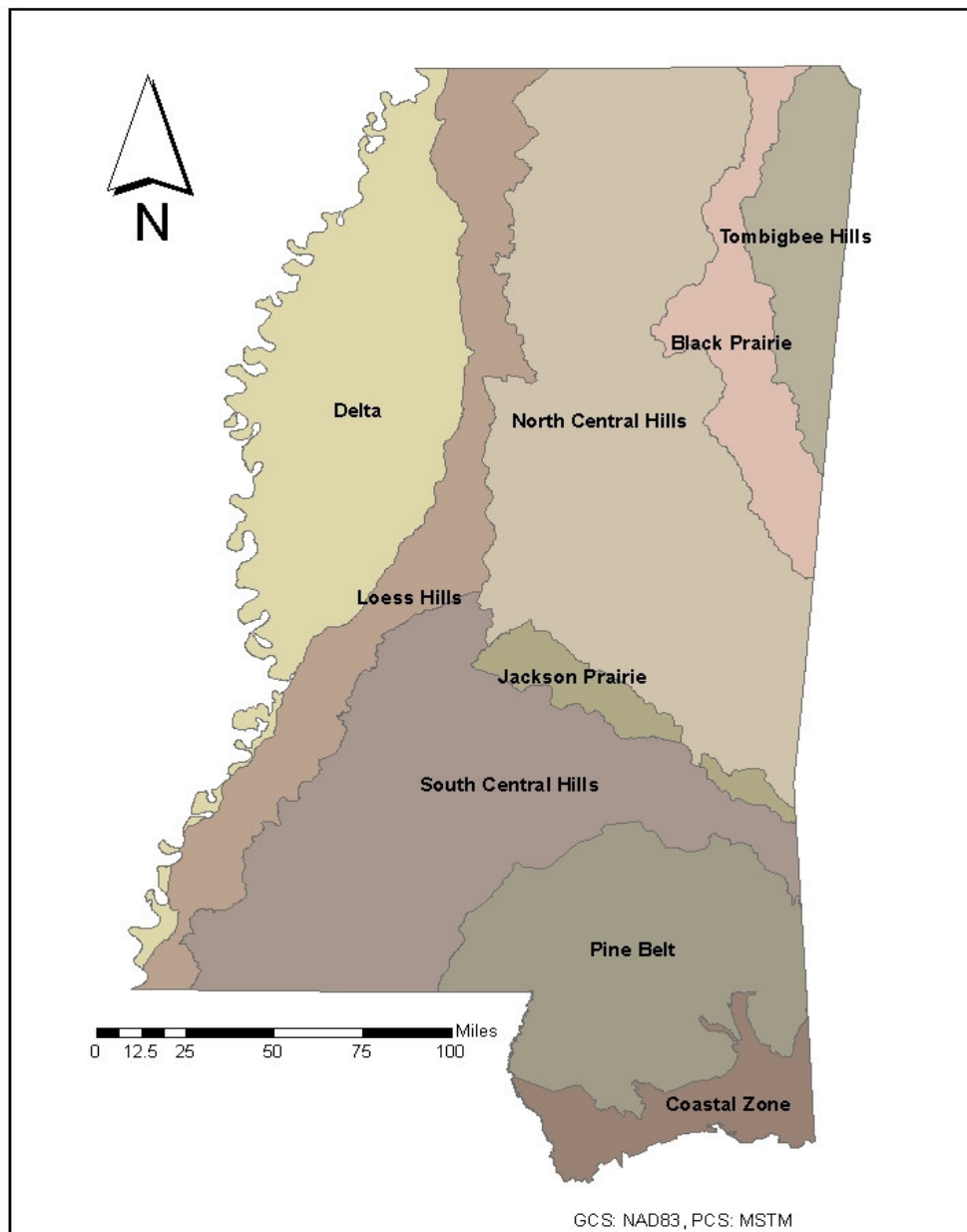


Figure 2. Location of Mississippi's Physiographic Provinces

Within the NFsMS, Soil Resource Inventories (SRIs) have identified approximately 93 soil series. Soil series are the grouping of soils with similar physical and chemical properties. Soil series can be further divided into soil map units which are phases of a soil series with more specific properties, such as slope, flood frequency, surface texture, etc. About 170 soil map units have been identified within the NFsMS. The units range from sandy deep excessively well drained to soils with high

shrink-swell clays with poor internal drainage. Slopes range from nearly level to very steep in upland (up to 60 percent) and nearly level or gently sloping in floodplains and wetlands.

Soil map units are then used to develop site-specific soil interpretations. These interpretations are used during project planning to identify soil suitability and management limitations within project areas. The ratings do not necessarily indicate the ability to implement project activities. Rather, they indicate the relative amount of protective measures needed to protect the soil resource and to successfully implement a chosen activity. These soil ratings are taken into account in the planning phase, or in the required protective measures. An example of this would be a poor rating for access roads due to slope. One solution for this would be to locate the road on the ridgetop or along the contour of the slope, instead of locating the road straight up and down the slope. Another example is in the specifications for waterbar construction. Closer spacing is required for waterbars on moderately and highly erosive soils than is required for waterbars on slightly erosive soils.

3.3.2.2 Environmental Effects - Alternative 1 – No Action

Under Alternative 1, new Federal oil and gas leases would not be allowed on the NFsMS. Therefore, no direct or indirect effects would occur. Alternative 1 would have a no change effect on soil productivity.

Since the Alternative 1 does not have a direct or indirect effect, an increased cumulative effect is not expected to be associated with implementation of this proposal. The effects occur from existing conditions, including activities associated with existing Federal oil and gas leases, SUPO's, APD's, Right-of-Way authorization, special use permits, timber harvest, prescribed burns, and existing system roads. In relationship to existing leases, estimates for a RFDS were developed in Table 5. The anticipated disturbance, over a 15-year period, is about 665 acres.

3.3.2.3 Environmental Effects - Alternative 2 – Consent to Leasing

The National Forest Management Act of 1976 requires activities to be managed in a way that does not significantly impair site productivity. Although this alternative does not have any direct soil effects; it does have indirect effects as result of implementation, in particularly, the surface disturbance associated with drilling and production for oil and gas, would have an impact. Indirect effects would be addressed in more site-specific NEPA analyses related to decisions such as SUPO's, APD's, Right-of-Way authorization, special use permits, etc. These effects depend on:

- 1) Type and extent of the activity (exploration, road construction, production, pipeline, etc.);
- 2) Location of the ground disturbing activities (i.e. soils and land capability of the affected site);
and
- 3) Timing of the activities.

The overall effects on soils are dependent on the type and extent of activity. Future estimates for a RFDS were developed in Table 7. Soils effects from drilling include disturbances from temporary road access plus soil disturbances at well sites. Should a discovery occur, soil effects from oil and gas production include the effects mentioned above plus the effects of pipeline construction. During the construction phase, prior to implementation of reclamation efforts, some small soil losses would occur. Generally, effects on soils would be low where BMPs are followed and where reclamation,

revegetation, and erosion control measures are implemented and are successful. Slope failure increases for excavations requiring extensive cut-and-fill operations. Excavation of pipeline trenches alters soil profiles, and can bring less productive sub-soil to the surface, resulting in revegetation and rehabilitation difficulties. If routes are placed on gentle slopes, the amount of cuts and fills would be reduced. Implementation of erosion control and revegetation measures immediately would reduce the amount of erosion. Under most situations, some soil erosion and productivity losses would occur until pipeline rights-of-way are stabilized (two to three years). This is considered a short-term impact.

The initial step toward reducing the risk of soil movement and loss of productivity is to avoid physical contact with highly-erodible soils. Locating well pads on more gently sloping surfaces greatly reduces the amount of cuts and fills and would result in less erosion. Where construction on steeper slopes is necessary, cuts and fills would be required and effects to soils would increase. Side hill cuts and fills on steep slopes would require extensive side wall cuts that could cause slope instability and could result in large volumes of soil and rock debris being used as fill or being deposited onto otherwise undisturbed areas. In cut areas, replacement of sidecast material, re-grading and revegetation is difficult, but required. Successful application of intensive revegetation and mechanical erosion control techniques would stabilize such areas within five years.

Often, construction of new access roads has the greatest effects on soil. Increased sediment entering stream channels originates from the development of roads. Water quality is affected by the number and location of roads, as well as by road construction and maintenance. Proper planning, construction, and maintenance can substantially reduce watershed sedimentation from roads. Similarly, road construction and use has the potential to activate areas susceptible to land slides, slumping, and/or mass erosion. Depending on the type of building or binding materials used, exposure of bare soil could result in varying degrees of continued erosion losses. These effects would be greatest where extensive side hill cuts are constructed. Additional effects from access road construction may include un-surfaced access roads that may rut in wet weather or were constructed in wet areas; and construction and maintenance activities reduce infiltration rates on road surfaces, disrupt natural drainage by concentrating overland flow, and channel run-off resulting in gully erosion.

Soil losses will be reduced or minimized through the application of Forest Service BMPs on a site-specific basis. Examples of such practices include use of erosion curtains to protect drainages, surfacing roads, water bars and check dams to control run-off, stockpiling of topsoil for reclamation and revegetation, and use of rip-rap for gully control and to stop stream head-cut. Other measures include appropriate engineering design of roads, well pads, and ancillary facilities; and avoidance of steep and/or unstable slopes and sensitive soils.

In addition, development of an oil and gas site can alter soil nutrient cycling through both tree removal, and removal of organic matter and duff layers on the forest floor (Marks and Bormann, 1972; Swank and Douglass, 1977; Bormann and Likens, 1979). The degree of impact to the site depends on the amount of surface soil displacement as well as the amount of biomass removed. On sites with more intense surface disturbance, topsoil is stockpiled for reclamation. Also, nutrient deficiencies are mitigated through the application of lime and fertilizer.

The effects occur from indirect effects of choosing Alternative 2 plus existing conditions, including activities associated with existing Federal oil and gas leases, SUPO's, APD's, Right-of-Way authorization, special use permits, timber harvest, prescribed burns, and existing system roads. In

relationship to existing leases, estimates for a RFDS were developed in Table 8. Realistically, drilling in the NFsMS experiences approximately 25 exploratory wells each year or 379 wells over a 15-year period. Using the RFDS drill location pads of 2 to 5 acres each for the projected 379 drill sites yields 2,354 acres potentially disturbed acres over 15 years. RFDS estimates that 30 percent of the exploration wells are successful, meaning that 70 percent of the 2,354 acres or 1,648 acres would be restored after the well is plugged. The remaining 30 percent or 116 wells would have the location sites reduced from five acres each to approximately 10,000 square feet each. This reduces the remaining 706 acres to 27 acres that remains impaired by the drilling. Production facilities would require an additional 141 acres of disturbance for production pipelines, bringing the total production disturbance to 167 acres over 15 years. For the projected 379 drill sites and 2,354 acres disturbed, only 167 acres would be in the production mode and un-restored at the end of the 15-year projected period. Reconditioning and restoration of the non-productive sites returns 93 percent of the disturbed soil to a condition of acceptable potential soil productivity.

At least 85 percent of an activity area should be left in a condition of acceptable potential soil productivity following land management activities (FSH 2509.18). Monitoring over the years, indicates that roughly nine percent of Forest Service activity areas are impacted by uses such as temporary access roads, fire lines, primary skid trails, log landings, special-use permits, and other ground disturbing activities that causes erosion. In some activity areas, indirect effects may increase the number of acres not meeting soil quality standards by roughly one percent. The overall cumulative impact is likely to increase to about 10 percent soil quality impairment; however, the cumulative effect is not likely to exceed the 15 percent soil impairment threshold.

3.3.3 WATER RESOURCES

The NFsMS protects, restores, and monitors physical, chemical and biological integrity of water of the United States in accordance with environmental regulations. This project would comply with requirements of the Clean Water Act and other environmental regulations, such as the Comprehensive, Environmental Response Compensation and Liability Act, Superfund Amendment and Reauthorization Act, Toxic Substance Control Act, and others and the Forest Plan standards and guidelines.

Short-term and long-term oil and gas activities and operations include construction, installation, exploration, and soil-related excavation (i.e., placement sites, constructing road access, staging drilling pads, and installing collection /distribution lines). For example, installing and/or removing equipment from staging work areas or constructing road access or right-of-ways can cause sedimentation in protected water bodies (wetlands, rivers, and lakes).

3.3.3.1 Current Condition

The quality of groundwater resources in Mississippi is quite good. Generally, most of the aquifers contain water that is good. Usually, shallow aquifers have low pH, soft to moderately hard, and contain low dissolved solids and high carbon dioxide content; whereas, deeper aquifers usually contain water that is alkaline (high pH), soft and contains higher dissolved solids (Shows, 1970). Most of the drinking water supply in the state is obtained from deep aquifers which are naturally protected to some extent by overlying clay (confining) layers. Incidents of groundwater contamination impacting large segments of the population have been rare. Most of the documented cases involving ground water problems have been localized incidents, which have been traced to sources, such as leaky, underground (gasoline) storage tanks (USTs) in outcrop-recharge areas.

Oil and gas development activities have rarely affected water quality in the past. Accidental discharges of brine and crude oil have occasionally occurred; and should the discharges reach streams, ponds, or lakes, can deleteriously affect water quality.

Monitoring of water quality within the NFsMS revealed no consistent or recurring situations at Designated Recreation Areas. Federal and state water quality standards are being met at other established monitoring sites with exceptions in and around the Black Creek watershed located on the De Soto NF where turbidity recordings exceed the background turbidity more than 50 nephelometric turbidity units (NTUs). Most streams monitored specifically for oil and gas effects on water quality met state water quality standards, except for Pretty Creek, located in the Homochitto River watershed which has historically reflected relatively high (greater than 1.0 micromhos/cm) specific conductivity values. That watershed was also known as a containment area (NFsMS, 2006).

In regard to oil and gas effects on water quality, brine and oil leaks or spills have occasionally occurred; however, their effects are limited by a number of preventative and protective measures. Facilities are inspected and deficiencies corrected. Oil and gas operators must provide and implement a Spill Prevention and Counter-Measure Plan that identifies preventative measures and remediation procedures for implementation if a spill occurs. Size of spills vary and are effectively monitored by probes or sensors at different points in the facilities. Sensors are designed to stop pipeline flow when declining pressure is detected. As a result, oil and gas adverse effects seldom reach streams; thus indicating no observable water quality impacts. For example, relatively high specific conductivity in Pretty Creek is thought to be the result of historical production activity prior to enactment of environmental laws, as specific conductivity has remained high for decades in this stream, where insignificant active oil and gas activity remains in the area (NFsMS, 2006).

3.3.3.2 Environmental Effects – Alternative 1 – No Action

This alternative would not immediately change mineral leasing effects currently occurring. There are no direct effects from leasing. Estimates of a RFDS were developed for the No Action Alternative (see Table 5). There may still be disturbance associated with leases on NFS lands with privately owned mineral rights. Disturbance might still occur on the 10 percent of NFS lands with these privately held rights.

The cumulative effects acres of surface disturbance projected for each activity level for Alternative 1 is less than one-seventh of one percent of the NFS lands on the NFsMS.

3.3.3.3 Environmental Effects - Alternative 2 – Lands Available for Leasing

Alternative 2 has no direct effects from leasing. Exploration and development are likely connected and follow as indirect actions. Estimates of a RFDS were provided earlier in Chapter 2 and summarized in Table 8. The estimate of anticipated disturbance under Alternative 2 is 1,737 acres, or 116 acres per year.

The potential indirect effects to surface water include sediment loading of stream channels due to the earthwork associated with site construction. Also potential indirect effects to surface water include water consumption during the early development of a field could have a short-term adverse effect on local stream flow and secondary effects on downstream water use due to changes in water quantity or quality.

The potential indirect effects to ground water could include transfer of drilling fluids and saline production water to fresh water aquifers if wells are not properly constructed. Also introduction of pollutants from spills and releases via exposed ground surfaces to subsurface aquifers from oil/produced water treatment, storage tanks and handling facilities, sanitary facilities, and oil/produced water transportation facilities (trucks, pipelines).

The potential indirect effects to ground water include water consumption for road watering and drilling fluids during the early development of a field could have a short-term adverse effect on local groundwater levels and secondary adverse effects of each of the above on seeps and springs.

Construction of roads, drilling pads and collection/distribution lines would result in both short and long-term effects. This would result in a loss of vegetation growth due to clearing, grading and future maintenance of the transportation system. This would lead to soil exposure and susceptibility to erosion and deposition in streams and channels.

In summary, both ground and surface water quality may be impacted for relatively short periods of time. Cumulative effects may result from site constructions and excavations which attributes to natural re-suspension of materials in water resources due disturbance of sediments.

Some disturbance associated with minerals development on NFS lands is associated with privately owned mineral rights. This might occur on the 10 percent of NFS lands with these privately held rights. . Given the intermixing of private and public lands within the subject areas, oil and gas or other development activities, on NF lands as well as private lands and private minerals would contribute to the cumulative effects affecting water quality.

3.4 AIR

Mississippi has some of the cleanest air in the Nation, which contributes to our high quality of life and helps protect our environment. The air quality in each of Mississippi's 82 counties meets new, stricter guidelines for fine particulate matter set by the U.S. Environmental Protection Agency (EPA) (MDEQ, 2008). Air quality guidelines relate to readings as follows: 1-hour ozone levels, 8-hour ozone levels, carbon monoxide, sulfur dioxide, particulate matter, and lead emissions.

3.4.1 Current Condition

Currently, Mississippi air quality standards, established and guided by the EPA in coordination with the MDEQ, is 84 parts per billion (ppb). However, EPA has set a new state air quality standard at 75 ppb. Currently, there are no Class I airshed within the state. Although Mississippi currently (2009) meets EPA's National Ambient Air Quality Standards, 3 of the 82 counties are potentially at risk of becoming non-attainment areas creating a need to protect stratospheric ozone and reduce ground level ozone. Counties designated and recommended as air quality non-attainment areas, based on 2006-2008 data, are De Soto, Harrison, and Jackson counties. MDEQ records air quality indices, by county, throughout the state (www.deq.state.ms/us/aqi).

The southern-most portion of the De Soto District of the De Soto NF is included in parts of Harrison and Jackson Counties and De Soto County, near the Holly Springs District-North unit (See Figure 3, #78 & 81).

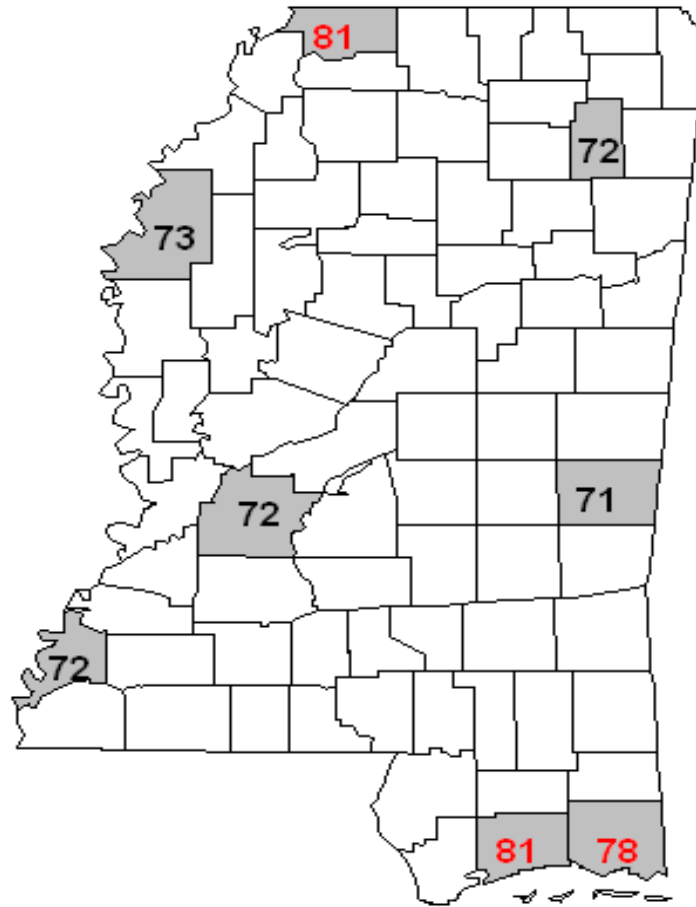


Figure 3. 8-Hour Ozone Values (ppb), 2006 - 2008

Note: New air quality standard = 75 ppb; old standard = 84 ppb (standards based on 3-year averages)

3.4.2 Environmental Effects – Alternative 1 – No Action

Air quality issues for the proposed project stem mainly from vehicle transportation to the placement site and emitted fumes from production facilities. Effects may include dust particles from access roads and various byproducts of the combustion of fossil fuel, such as discharge of particulate matter and discharge of sulfur dioxide from modified fuel burning. Whereas, indirect effects to air quality may include possible odors associated with sediment as it is exposed to the atmosphere. In comparison to other such sources of possible impairment to air quality, the contribution associated with the proposed project is considered to be insignificant.

3.4.3 Environmental Effects - Alternative 2 – Lands Available for Leasing

The incremental difference between proposed activities that may affect air quality for Alternatives 1 and 2 are considered to be immeasurable. Therefore, the impacts for either alternative would be similar and result no anticipated (measurable) adverse impacts to air quality.

3.5 TRANSPORTATION SYSTEM

3.5.1 Current Condition

A Forest scale roads analysis was completed in 2006 as part of the Forest Plan revision process (USDA Forest Service, Roads Analysis National Forests in Mississippi, November 2006). The transportation network is comprised of 2,400 miles of forest development roads and 793 miles of state and county roads divided into six percent arterial, 14 percent collector, and 80 percent local roads. The arterial and collector system is essentially in place.

3.5.2 Environmental Effects - Alternative 1 – No Action

Under Alternative 1, no new oil and gas leases for exploration would be issued. However, existing leases would continue until expired, terminated or are relinquished. No direct environmental effects would result from the leasing itself. However, indirect effects related to the existing leases can be estimated as discussed in the assumed projections from the BLM analysis of the RFDS. Indirect effects would generally be analyzed in a site-specific NEPA analysis following the submission of an APD by the leaseholder or agent at the time drilling is proposed. The RFDS estimates the need for approximately 1/3 mile of access road per well pad. The access road would be an extension of existing local roads or spurs off of existing arterial or collector roads. The RFDS provides an estimate of the acres of road access disturbance anticipated for each scenario evaluated (see Table 5). Under the No Action Alternative, the average annual miles of access roads required would range from 2 to 5 miles per year forest-wide for mineral exploration. Assuming 30 percent of the wells go into production this would translate into approximately 0.5 to 2 miles of roads per year developed and maintained for long-term mineral access.

Cumulative effects under Alternative 1, No Leasing Action, would be no change from current activities. Most of the additional cumulative effects would come as results of activities on private owned land and land which have reserved or outstanding mineral estates.

3.5.3 Environmental Effects - Alternative 2 – Lands Available for Leasing

Under Alternative 2, new areas would be made available for leasing in addition to areas currently under existing leases (as existing leases expire, are terminated or are relinquished). As with Alternative 1, no direct environmental effects would result from the leasing itself. However, indirect effects related to existing and future leases can be estimated as discussed in the assumed projections from the BLM analysis of the RFDS. Indirect effects would generally be analyzed in a site-specific NEPA analysis following the submission of an APD by the leaseholder or agent at the time drilling is proposed. The RFDS provides an estimate of the acres of road access disturbance anticipated for each scenario evaluated (see Table 8). Under Alternative 2, the average annual miles of access roads required would range from 5 to 14 miles per year forest-wide for mineral exploration. Assuming 30 percent of the wells go into production the miles of access roads would be approximately 1 to 4 miles of roads per year developed and maintained for long-term mineral access.

3.6 VEGETATION

3.6.1 Current Condition

Distributed across the State of Mississippi, national forest lands include an array of ecological systems that range from fire-dependent stands of longleaf pines along the Gulf Coastal Plain to the upland oaks and hickories that dominate dry slopes and ridges in the northern half of the state. In other upland areas, the sheltered bluffs and mesic ravines where fire is naturally rare contain an entirely different combination of hardwoods that includes American beech, white oak, and Southern magnolia. The Delta NF is the only bottomland hardwood National Forest in the National Forest System (NFS). Other forested wetland areas across the state include stands of bald cypress imbedded along oxbow lakes and sloughs, streamside riparian hardwoods, and herbaceous seeps and flats.

Statewide, pine-dominated stands, many of which resulted from reforestation efforts in the 1930s, are the most common forest communities. Loblolly pine is the predominant forest type. However, the NFsMS also offer a refuge for unique and rare plant communities such as pitcher plant bogs, open grassy prairies, ephemeral ponds, and xeric sandhills. The relative size and diversity of the NFS land base within the state is important for recovery of native ecosystems and threatened and endangered wildlife species such as red-cockaded woodpeckers and gopher tortoise.

The vegetation systems are diverse in terms of age as well. An important component or characteristic of vegetation are the areas of older age. Based on current data in the NFsMS vegetation database there is approximately 10 percent identified as potential old growth stands. This 10 percent is composed of stands contained in congressional or administrative designations currently withdrawn from the timber base, identified for red-cockaded woodpecker nesting habitat needs, designated as late seral, aged at or older than old growth community definitions, or identified by Forest staff as rare community types. Regional old growth guidance is contained in a Southern Region report titled “*Guidance for Conserving and Restoring old-Growth Forest Communities on National Forests in the Southern Region. Report of the Region 8 Old-Growth Team June 1997*”. The *National Forests in Mississippi Old Growth Guide* strategy for implementing this guidance would assure an appropriate network of old-growth distributed across the Forest.

There are introduced species of vegetation present on the NFsMS and surrounding land ownerships. Some of these species are aggressive in displacement of native species or dominating disturbed sites. Examples are non-native invasive species (NNIS) like kudzu (*Pueraria montana*), and cogongrass (*Imperata cylindrica*). These exotic, invasive species pose a serious threat to plant and animal community health and diversity. Since exotic species, by definition, have been transplanted outside their original range, they often lack natural controls (i.e., disease, predators, parasites, or climate), which allows them to out compete and eventually replace more sensitive native species. Once NNIS become established, they are extremely difficult to eradicate, and the resulting change in community plant composition can alter ecosystem dynamics and functions over time. With any management activity that requires the use of heavy equipment brought in from off-site, there is a high risk of transporting NNIS into the project area. Furthermore, control of these exotic species, once they become established, would likely be a long-term endeavor in forested areas where oil and gas operations provide continuing avenues for NNIS invasion.

Oil and gas exploration and development generally progresses through three operational phases: 1) preliminary exploration, 2) exploratory drilling, and 3) development, production and abandonment. The preliminary investigations often require only “casual” surface presence, but off-road vehicle

travel and some access road construction can occur, particularly if seismic reflection or geophysical surveys are used in exploration. This could result in vehicular damage to unfenced sensitive plant populations. Potential direct effects of oil and gas development on botanical resources are greatest during exploratory drilling and oil/gas field development phases. Direct surface disturbance to vegetation and topsoil results from the construction of access roads, well pads and associated features. Typically an individual well pad requires the clearing of vegetation and topsoil and an access road. The acreage and location of associated facilities (flowlines, distribution pipelines and treatment facilities) are unknown. Typically, pipelines must be constructed in a linear fashion requiring the excavation of 10 to 15 foot wide strip that is backfilled and revegetated shortly after construction. The well pads and other facilities would be revegetated as part of interim and final reclamation.

The 2 to 5 acre openings, and associated roads and pipelines, resulting from oil and gas development may have effects on plant communities. Effects would include direct habitat loss and indirect effects on adjoining plant communities. Removal of vegetation for roads, pads and pipelines causes direct loss to portions of plant communities. The effects of ground disturbance on vegetation are most important in areas that have not been greatly disturbed in the past, in areas where rare species or communities occur, and in areas with the greatest potential for restoration of natural plant communities and ecosystems.

Indirectly, development of an oil and gas site would affect vegetation by altering nutrient cycling through both tree removal, and removal of organic matter and duff layers on the forest floor (Marks and Bormann, 1972; Swank and Douglass, 1977; Bormann and Likens, 1979). The degree of impact to the site depends on the amount of biomass removed, where greater biomass removal results in greater effects to nutrient cycling. The site would eventually be revegetated to grasses and some forbs; however, studies have shown that trees contribute more to nutrient cycling than other vegetation types (Monk and Day, 1987).

Vegetation may be affected far beyond the area of actual soil disturbance due to edge effects. The “edge effect” causes alterations in the microclimate along these disturbed edges, including: 1) changes in radiation, which affect air temperature and light, 2) changes in the wind profile, which can compromise stand structure and alter relative humidity, and 3) changes in the local water regime, which can affect surface and groundwater flow, rainfall interception, soil run-off and deposition, and evapotranspiration (Saunders et al. 1991; Ranney et al. 1981). In general, forest areas next to openings tend to have higher temperatures, increased wind exposure, higher solar radiation, and lower humidity (Brothers and Springarn 1992), conditions which have been found to cause increased water stress in understory trees closer than 30 meters to forest edges compared to those in the interior (Jacquart et al. 1992).

These changes in microclimate may result in changes in plant species composition. In general, plant species adapted to high light levels and drier conditions were favored close to the forest edge, pushing species that require full shade and mesic conditions further into the forest. Since the forest matrix has been reduced in size due to fragmentation (the edge-creating activity), a larger number of specially adapted species are forced to compete for a smaller amount of suitable habitat. For example, several Federal, regional, and state listed rare plant species require the full shade and mesic conditions found in sites such as wooded stream terraces, floodplains, ravines, beech-maple and mixed mesophytic woods (the latter two communities primarily on north- to east-facing slopes). If

openings were placed in the vicinity of these species, they could be negatively impacted by microclimatic changes or by competition from species adapted to open conditions.

Native vegetation and suitable habitat for rare species would be lost where access roads, oil and gas well pads, and storage tanks are constructed. As previously mentioned, such a loss is most important in areas that have not been greatly disturbed in the past, in areas where rare species or communities occur, and in areas with the greatest potential for restoration of natural plant communities and ecosystems.

Effects on old growth should be minimal. Some old growth areas would be excluded from ground disturbing activities because of their special designations or use by red-cockaded woodpeckers. Disturbance which alters old growth character of any stand identified as possible old growth would be compensated for by identifying replacement stands to provide old growth under the NFsMS old growth guidance.

3.6.2 Environmental Effects - Alternative 1 – No Action

This alternative would not immediately change mineral leasing effects currently occurring. There are no direct vegetation effects from leasing. Estimates of a RFDS were developed for the No Action Alternative (see Table 5). There may still be disturbance associated with leases on NFS lands with privately owned mineral rights. Disturbance might still occur on the 10 percent of NFS lands with these privately held rights.

The cumulative effects acres of surface disturbance projected for each activity level for Alternative 1 is less than one-seventh of one percent of the NFS lands on the NFsMS.

3.6.3 Environmental Effects - Alternative 2 – Lands Available for Leasing

Alternative 2 has no direct vegetation effects from leasing. Exploration and development are likely connected and follow as indirect actions. Estimates of a RFDS were provided earlier in Chapter 2 and summarized in Table 8. The estimate of anticipated disturbance under Alternative 2 is 1,737 acres, or 116 acres per year.

Some disturbance associated with minerals development on NFS lands is associated with privately owned mineral rights. This might occur on the 10 percent of NFS lands with these privately held rights.

Cumulative impacts may pose barriers to preservation and recovery of listed species. Species so listed are often at population levels deemed non-viable and actions to improve their status are essential. Additional effects to their habitats, however limited, further reduce capabilities of recovery. Future Forest management decisions and actions such as prescribed burning, new road building, recreation activities and wildlife management projects would affect the present biological systems. The effects of these actions can improve or inhibit, or both, long-term management of these biological systems, depending upon the species or species group. Given the intermixing of private and public lands within the subject areas, oil and gas or other development activities, on NF lands as well as private lands and private minerals would contribute to the cumulative effects affecting vegetation management.

3.7 WILDLIFE

3.7.1 Current Condition

There are an estimated 2,500 plant species and 306 animal species that occupy an extremely wide array of habitats across the diverse landscapes of the NFsMS. Habitat management is designed to provide for a diversity of cover types and successional stages to sustain native and desired non-native wildlife species. Forest lands serve as refuges for unique or rare species, offer large contiguous forested areas where animal species can successfully reproduce and rear their young, afford key rest and feeding areas for waterfowl and other migratory bird species, and provide important linkages (travel corridors) between state and Federal wildlife refuges and other blocks of forested land.

One focus of habitat management programs is on demand species associated with recreational wildlife pursuits such as hunting, fishing, and viewing. Because these activities are generally limited or restricted on private lands, the NFsMS offers a unique opportunity within the State for those wishing to participate in these activities. Some demand species of interest are white-tailed deer, eastern wild turkey, fox and gray squirrels, northern bobwhite, eastern bluebird, and a diversity of neo-tropical migratory birds passing through during migration.

The NFsMS has 14 wildlife management areas designated throughout its seven Ranger Districts which are managed under a cooperative agreement between the Forest Service and the Mississippi Department of Wildlife, Fisheries and Parks (MDWFP). While MDWFP holds authority for regulation of hunting and trapping and provides equipment and labor for wildlife food plots, the NFsMS is primarily responsible for protecting and managing habitat.

3.7.2 Threatened, Endangered, Sensitive Species

3.7.2.1 Affected Environment

Native ecosystems that exist provide various habitat needs for threatened and endangered species that are being monitored and managed on the NFsMS. These ecosystems also provide various habitats for Regional Forester listed sensitive species (RFSS). Landscape scale forest communities include open, park-like pine forests on drier uplands, mixtures of pines and hardwoods on moist uplands and side slopes, and riparian forests along many perennial and intermittent streams. Threatened, endangered, and sensitive species (TES) species on the NFsMS are listed in the Biological Evaluation (BE) in Appendix D.

3.7.2.2 Species Considered and Evaluated

The Regional Forester's list of "sensitive" species for the NFsMS (USDA 2001) and the NFsMS Threatened and Endangered species list (USDI Fish and Wildlife Service (USFWS), 2006) were reviewed to devise a target list of species to be considered for this project. A review of existing information was conducted to further refine the list of potential TES species occurring in the project area. TES species which occur or whose habitat occurs in the project area were identified and the potential effects to these species or their "affected area" by the proposed action were further analyzed. A list of sensitive species grouped by their "affected area" is also included in Appendix D.

The results of this effects analysis are summarized in the BE in Appendix D, where a detailed description of the species selection process and effects analysis was concurred on by the USFWS. A copy of the USFWS concurrence letter is also included in Appendix D.

3.7.2.3 Environmental Effects on TES Species - Alternative 1 – No Action

This alternative would not immediately change mineral leasing effects currently occurring. See the discussion in Alternative 2 below for typical effects on TES species related to oil and gas exploration and development. There are no effects from leasing. Exploration and development are likely connected and follow on actions. Estimates of a RFDS were developed for the No Action Alternative (see Table 5). The disturbance effects would eventually be reduced under the no action alternative as current Federal leases expire. There may still be disturbance associated with leases on NFS lands with privately owned mineral rights. Disturbance might still occur on 10 percent of NFS lands with these privately held rights. Current conditions and trends would continue. Direct and indirect effects (Table 14) of exploration and development associated with Alternative 1 on TES species include habitat modification through vegetation and soil disturbance, abandonment of disturbed areas in favor of undisturbed sites, behavioral alterations affecting mating, feeding and predator avoidance, and nest abandonment.

Table 14. Current Effects of Associated Exploration and Development to Alternative 1 on TES Species

Species	Effects
<i>Red-cockaded Woodpecker</i>	Human disturbance and Habitat degradation
<i>Gopher Tortoise</i>	Human disturbance and Habitat degradation
<i>Louisiana Black Bear</i>	Human disturbance and Habitat degradation
<i>Mississippi Gopher Frog</i>	Human disturbance and Habitat degradation
<i>Louisiana Quillwort</i>	Human disturbance, Sedimentation, erosion, and habitat degradation
<i>Pondberry</i>	Human disturbance and Habitat degradation
<i>Mississippi Sandhill Crane</i>	Human disturbance and Habitat degradation
<i>Gulf Sturgeon</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed
<i>Pallid Sturgeon</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed
<i>Eastern Indigo Snake</i>	Human disturbance and Habitat degradation
<i>Southern Clubshell</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed
<i>Price's Potato Bean</i>	Human disturbance and Habitat degradation
<i>Mitchell's Satyr</i>	Human disturbance and Habitat degradation
<i>Flatwoods, Savannahs, and Bogs</i>	Human disturbance and Habitat degradation
<i>Pine Uplands and Sandhills</i>	Human disturbance and Habitat degradation
<i>Swamps, Cypress Ponds, Pond/Lake Margins, River/Stream Banks, Seeps and Springs</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed
<i>Floodplain/Bottomland Hardwoods</i>	Human disturbance and Habitat degradation
<i>Moist Rocky Woods/Outcrops</i>	Human disturbance and Habitat degradation
<i>Aquatic</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed
<i>Prairie and Calcareous Soils</i>	Human disturbance and Habitat degradation
<i>Mesic Slope</i>	Human disturbance and Habitat degradation

Source: NFsMS

Analysis of the cumulative effects considered the potential impacts of the no action alternative, when combined with potential impacts of other activities. The activities considered include past, present, and reasonably foreseeable future actions. These activities are within the appropriate area of possible impact for each resource considered. Clearing of the land for agriculture, mining, oil and gas development, draining of wetlands and loss of riparian areas has affected the water quality of streams and impoundments on public and private land. Riparian areas and wetlands are being restored on the Forest, but other activities, especially on lands in other ownerships, are still impacting aquatic communities. The greatest amount of oil and gas development on and near the NFsMS has been associated with private land and/or reserved mineral estates, adjacent to or intermixed with NFsMS. Future development will mostly be associated on private or reserved rights. Therefore, the cumulative effects on TES will be dependent more upon the development of those estates.

The no action alternative will have minimal cumulative effects on TES because of the relatively small amount of disturbance foreseen. Management of animal communities on a landscape level focuses on maintaining the integrity of forest ecosystems by minimizing long-term human alterations (roads and permanent openings), particularly in relatively undisturbed habitats. Cumulative effects may occur to aquatic ecosystems and their respective species as a result of increases in sediment run-off from well pads and roads; increases in contaminants from point and non-point sources; and potential changes in amounts of surface water if oil and gas drilling intercepts natural underground flow regimes. Considering the total amount of disturbance that has, is, and will be occurring within the forests, and which ultimately affects the status and distribution of animal species, the cumulative impact of the no action alternative will be minor.

3.7.3.2.4 Environmental Effects on TES Species - Alternative 2 – Lands Available for Leasing

Effects associated with oil and gas leasing would have no direct effects on TES species. Exploration and development (construction of roads, well pads, and pipeline corridors) in connection with leasing, however, could have both direct and indirect effects on TES species (Table 15). Animals may be displaced from the immediate area of development. Animals which are displaced may initially be absorbed by surrounding habitats, causing short-term changes in population densities in surrounding areas. Habitat quality could be reduced for some species in the vicinity of development activity due to loss of important structural components (canopy levels within the Forest and down woody material), fragmentation of habitats, development of barriers to travel for some species, and microclimatic changes resulting from openings. Species sensitive to human intrusions may be affected by added oil and gas operations, especially where new activities occur in relatively undisturbed areas. Timing of activities could amplify these effects; for instance, disturbance during nesting or rearing periods of species with small home ranges such as birds, could result in reduced or failed reproduction.

Terrestrial species may be affected by certain activities under Alternative 2, namely tree or brush removal, or soil disturbance. Aquatic species may be affected by sediment movement off-site from the developments, or from accidental spills of oil and gas materials. Conditions of Approval in the APD would protect aquatic habitats and aquatic species in riparian area, waterhole, wetland and pond/lake. Specific guidance for protection of TES resources from effects due to oil and gas activities or other activities is displayed in the Forest Plan and in the Protective Measures identified in Chapter 2, Section 2.4. Because of these protective measures and the fact that little disturbance is expected to occur as a result of implementing Alternative 2 (0.3 percent of forest land would likely be impacted), the overall impact to TES would be insignificant.

Table 15. Potential Effects of Associated Exploration and Development to Alternative 2 on TES Species

Species	Effects
<i>Red-cockaded Woodpecker</i>	Human disturbance and Habitat degradation
<i>Gopher Tortoise</i>	Human disturbance and Habitat degradation
<i>Louisiana Black Bear</i>	Human disturbance and Habitat degradation
<i>Mississippi Gopher Frog</i>	Human disturbance and Habitat degradation
<i>Louisiana Quillwort</i>	Human disturbance, Sedimentation, erosion, and habitat degradation
<i>Pondberry</i>	Human disturbance and Habitat degradation
<i>Mississippi Sandhill Crane</i>	Human disturbance and Habitat degradation
<i>Gulf Sturgeon</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed
<i>Pallid Sturgeon</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed
<i>Eastern Indigo Snake</i>	Human disturbance and Habitat degradation
<i>Southern Clubshell</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed
<i>Price's Potato Bean</i>	Human disturbance and Habitat degradation
<i>Mitchell's Satyr</i>	Human disturbance and Habitat degradation
<i>Flatwoods, Savannahs, and Bogs</i>	Human disturbance and Habitat degradation
<i>Pine Uplands and Sandhills</i>	Human disturbance and Habitat degradation
<i>Swamps, Cypress Ponds, Pond/Lake Margins, River/Stream Banks, Seeps and Springs</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed
<i>Floodplain/Bottomland Hardwoods</i>	Human disturbance and Habitat degradation
<i>Moist Rocky Woods/Outcrops</i>	Human disturbance and Habitat degradation
<i>Aquatic</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed
<i>Prairie and Calcareous Soils</i>	Human disturbance and Habitat degradation
<i>Mesic Slope</i>	Human disturbance and Habitat degradation

Source: NFsMS

Analysis of the cumulative effects considered the potential impacts of the proposed alternative, when combined with potential impacts of other activities. The activities considered include past, present, and reasonably foreseeable future actions. These activities are within the appropriate area of possible impact for each resource considered, along with the proposed activities (project record). Clearing of the land for agriculture, mining, oil and gas development, draining of wetlands and loss of riparian areas has affected the water quality of streams and impoundments on public and private land. Riparian areas and wetlands are being restored on the Forest, but other activities, especially on lands in other ownerships, are still impacting aquatic communities. The greatest amount of oil and gas development on and near the NFsMS has been associated with private land and/or reserved mineral estates, adjacent to or intermixed with NFsMS. Future development will mostly be associated on private or reserved rights. Therefore, the cumulative effects on TES will be dependent more upon the development of those estates.

The development of oil and gas resources proposed in this environmental assessment will have minimal cumulative effects on TES because of the relatively small amount of disturbance foreseen,

and because of the protective measures and stipulations which would be implemented and monitored. Management of animal communities on a landscape level focuses on maintaining the integrity of forest ecosystems by minimizing long-term human alterations (roads and permanent openings), particularly in relatively undisturbed habitats. Cumulative effects may occur to aquatic ecosystems and their respective species as a result of increases in sediment run-off from well pads and roads; increases in contaminants from point and non-point sources; and potential changes in amounts of surface water if oil and gas drilling intercepts natural underground flow regimes. Considering the total amount of disturbance that has, is, and will be occurring within the forests, and which ultimately affects the status and distribution of animal species, the cumulative impact of the proposed action will be minor.

3.7.3 Management Indicator Species

3.7.3.1 Affected Environment

Under the NFMA (1976), the Forest Service is charged with managing National Forests to provide for a diversity of plant and animal communities consistent with multiple-use objectives. Management indicator species (MIS) are one tool used to accomplish this requirement as they and their habitat needs are used to set objectives and minimum management requirements, to focus effects analysis, and to monitor effects of plan implementation. MIS were selected in the 1985 Forest Plan to serve three major functions: 1) represent issues of hunting demand, 2) consider species for which population viability is a concern, and 3) serve as ecological indicators of certain communities or habitats.

The NFMA (1976) intends use of management indicator species, in part, to ensure that NFS lands are managed to “maintain viable populations of existing native and desirable non-native vertebrate species.” Because indicator species cannot adequately represent all species (*op. cit.*), new strategies are emerging for accomplishing this goal. This analysis uses habitat availability for MIS to ensure that a mix of habitat types is provided across the landscape. The BE serves to ensure that those species most at risk of losing viability (threatened, endangered, and sensitive species) are not negatively affected.

Available information related to MIS has been compiled and consolidated to provide as clear a picture as possible of how indicator species have responded to management activities or the absence of such activities. The current report, *Management Indicator Species Population and Habitat Trends, March 2005*, is available to the public on the NFsMS web site (<http://www.southernregion.fs.fed.us/mississippi/>).

The MIS for the NFsMS are presented in Appendix E, Table E-1. The impacts to the listed species indicate impacts on other wildlife species that use similar habitat. The aquatic species groups act as indicator species for good water quality. The associated habitats of these species and the Districts in which they occur on NFsMS are presented in Appendix E, Table E-2.

3.7.3.2 Environmental Effects on MIS - Alternative 1 – No Action

This alternative would not immediately change mineral leasing effects currently occurring. This analysis is for a leasing decision. There are no effects from leasing. Exploration and development are likely connected and follow on actions. Estimates of a RFDS were provided earlier in Chapter 2

and summarized in Table 5. Indirect effects (Table 16) of exploration and development associated with Alternative 1 on MIS include habitat modification through vegetation and soil disturbance, abandonment of disturbed areas in favor of undisturbed sites, behavioral alterations affecting mating, feeding and predator avoidance, and nest abandonment.

Table 16. Potential Current Effects of Associated Exploration and Development to Alternative 1 on MIS

Species	Effects
<i>White-tailed Deer</i>	Human disturbance and Habitat degradation
<i>Bachman's Sparrow</i>	Human disturbance and Habitat degradation
<i>Northern Bobwhite</i>	Human disturbance and Habitat degradation
<i>Eastern Meadowlark</i>	Human disturbance and Habitat degradation
<i>American Kestrel</i>	Human disturbance and Habitat degradation
<i>Rufous-sided Towhee</i>	Human disturbance and Habitat degradation
<i>Wild Turkey</i>	Human disturbance and Habitat degradation
<i>Pileated Woodpecker</i>	Human disturbance and Habitat degradation
<i>Red-cockaded Woodpecker</i>	Human disturbance and Habitat degradation
<i>Gopher Tortoise</i>	Human disturbance and Habitat degradation
<i>Fox Squirrel</i>	Human disturbance and Habitat degradation
<i>Pine Warbler</i>	Human disturbance and Habitat degradation
<i>Downy Woodpecker</i>	Human disturbance and Habitat degradation
<i>Screech Owl</i>	Human disturbance and Habitat degradation
<i>Gray Squirrel</i>	Human disturbance and Habitat degradation
<i>Hooded Warbler</i>	Human disturbance and Habitat degradation
<i>Delta Fox Squirrel</i>	Human disturbance and Habitat degradation
<i>Wood Duck</i>	Human disturbance and Habitat degradation
<i>Pitcher Plants</i>	Human disturbance, Sedimentation, erosion, and habitat degradation
<i>Northern Stream Fish (10 species listed)</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed
<i>Southwestern Stream Fish (8 species listed)</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed
<i>Southeastern Stream Fish (8 species listed)</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed
<i>Lake and Pond Fish (8 species listed)</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed

Source: NFsMS

Analysis of the cumulative effects considered the potential impacts of the no action alternative, when combined with potential impacts of other activities. The activities considered include past, present, and reasonably foreseeable future actions. These activities are within the appropriate area of possible impact for each resource considered. Clearing of the land for agriculture, mining, oil and gas development, draining of wetlands and loss of riparian areas has affected the water quality of streams and impoundments on public and private land. Riparian areas and wetlands are being restored on the Forest, but other activities, especially on lands in other ownerships, are still impacting aquatic communities. The greatest amount of oil and gas development on and near the NFsMS has been associated with private or reserved mineral estates, rather than on Federal minerals. Future development will mostly be associated on

private or reserved rights. Therefore, the cumulative effects on MIS will be dependent more upon the development of those estates.

The no action alternative will have minimal cumulative effects on MIS because of the relatively small amount of disturbance foreseen. Management of animal communities on a landscape level focuses on maintaining the integrity of forest ecosystems by minimizing long-term human alterations (roads and permanent openings), particularly in relatively undisturbed habitats. Cumulative effects may occur to aquatic ecosystems and their respective species as a result of increases in sediment run-off from well pads and roads; increases in contaminants from point and non-point sources; and potential changes in amounts of surface water if oil and gas drilling intercepts natural underground flow regimes. Considering the total amount of disturbance that has, is, and will be occurring within the forests, and which ultimately affects the status and distribution of animal species, the cumulative impact of the no action alternative will be minor.

3.7.3.3 Environmental Effects on MIS - Alternative 2 – Lands Available for Leasing

Effects associated with oil and gas leasing would have no effects on MIS. Exploration and development (construction of roads, well pads, and pipeline corridors) in connection with leasing could have indirect effects on MIS (Table 17). Animals may be displaced from the immediate area of development. Animals which are displaced may initially be absorbed by surrounding habitats, causing short-term changes in population densities in surrounding areas. Habitat quality could be reduced for some species in the vicinity of development activity due to loss of important structural components (canopy levels within the Forest and down woody material), fragmentation of habitats, development of barriers to travel for some species, and microclimatic changes resulting from openings. Species sensitive to human intrusions may be affected by added oil and gas operations, especially where new activities occur in relatively undisturbed areas. Timing of activities could amplify these effects; for instance, disturbance during nesting or rearing periods of species with small home ranges such as birds, could result in reduced or failed reproduction.

Terrestrial species may be affected by certain activities under Alternative 2, namely tree or brush removal, or soil disturbance. Aquatic species may be affected by sediment movement off-site from the developments, or from accidental spills of oil and gas materials. Riparian area, waterhole, wetland and pond/lake conditions of approval in APDs would protect aquatic habitats and aquatic species. Specific guidance for protection of MIS resources from effects due to oil and gas activities or other activities is displayed in the Forest Plan and in the Protective Measures identified in of Chapter 2, Section 2.4. Because of these protection measures and the fact that little disturbance is expected to occur as a result of implementing Alternative 2 (0.3 percent of forest land would likely be impacted), the overall impact to MIS would be insignificant.

Analysis of the cumulative effects considered the potential impacts of the proposed alternative, when combined with potential impacts of other activities. The activities considered include past, present, and reasonably foreseeable future actions. These activities are within the appropriate area of possible impact for each resource considered, along with the proposed activities (project record). Clearing of the land for agriculture, mining, oil and gas development, draining of wetlands and loss of riparian areas has affected the water quality of streams and impoundments on public and private land. Riparian areas and wetlands are being restored on the Forest, but other activities, especially on lands in other ownerships, are still impacting aquatic communities. The greatest amount of oil and gas development on and near the NFsMS has been associated with private and/or reserved mineral

estates. Future development will mostly be associated on private or reserved rights. Therefore, the cumulative effects on MIS will be dependent more upon the development of those estates.

Table 17. Current Effects of Associated Exploration and Development to Alternative 2 on MIS

Species	Effects
<i>White-tailed Deer</i>	Human disturbance and Habitat degradation
<i>Bachman's Sparrow</i>	Human disturbance and Habitat degradation
<i>Northern Bobwhite</i>	Human disturbance and Habitat degradation
<i>Eastern Meadowlark</i>	Human disturbance and Habitat degradation
<i>American Kestrel</i>	Human disturbance and Habitat degradation
<i>Rufous-sided Towhee</i>	Human disturbance and Habitat degradation
<i>Wild Turkey</i>	Human disturbance and Habitat degradation
<i>Pileated Woodpecker</i>	Human disturbance and Habitat degradation
<i>Red-cockaded Woodpecker</i>	Human disturbance and Habitat degradation
<i>Gopher Tortoise</i>	Human disturbance and Habitat degradation
<i>Fox Squirrel</i>	Human disturbance and Habitat degradation
<i>Pine Warbler</i>	Human disturbance and Habitat degradation
<i>Downy Woodpecker</i>	Human disturbance and Habitat degradation
<i>Screech Owl</i>	Human disturbance and Habitat degradation
<i>Gray Squirrel</i>	Human disturbance and Habitat degradation
<i>Hooded Warbler</i>	Human disturbance and Habitat degradation
<i>Delta Fox Squirrel</i>	Human disturbance and Habitat degradation
<i>Wood Duck</i>	Human disturbance and Habitat degradation
<i>Pitcher Plants</i>	Human disturbance, Sedimentation, erosion, and habitat degradation
<i>Northern Stream Fish (10 species listed)</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed
<i>Southwestern Stream Fish (8 species listed)</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed
<i>Southeastern Stream Fish (8 species listed)</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed
<i>Lake and Pond Fish (8 species listed)</i>	Water quality effects, Sedimentation, erosion, and effects on the watershed

Source: NFsMS

The development of oil and gas resources proposed in this environmental assessment will have minimal cumulative effects on MIS because of the relatively small amount of disturbance foreseen, and because of the protective measures and stipulations which would be implemented and monitored. Management of animal communities on a landscape level focuses on maintaining the integrity of forest ecosystems by minimizing long-term human alterations (roads and permanent openings), particularly in relatively undisturbed habitats. Cumulative effects may occur to aquatic ecosystems and their respective species as a result of increases in sediment run-off from well pads and roads; increases in contaminants from point and non-point sources; and potential changes in amounts of surface water if oil and gas drilling intercepts natural underground flow regimes. Considering the total amount of disturbance that has, is, and will be occurring within the forests, and which ultimately affects the status and distribution of animal species, the cumulative impact of the proposed action will be minor.

3.7.4 Migratory Landbird Conservation

Under the NFMA (1976), the Forest Service is directed to “provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives.” (P.L. 94-588, Sec 6 (g) (3) (B)). The January 2000 Forest Service Landbird Conservation Strategic Plan, followed by Executive Order 13186 in 2001, in addition to the Partners in Flight (PIF) specific habitat Conservation Plans for Birds and the January 2004 PIF North American Landbird Conservation Plan, all reference goals and objectives for integrating bird conservation into forest management and planning.

A Region-wide program for monitoring land bird populations has been developed. It involves establishing several thousand permanent monitoring stations on national forests across the South, covering all major physiographic regions and habitat types. Each point is visited yearly using standard procedures to record all birds present. The resulting data resides in a Regional database (R8Bird). Results of a regional analysis of this data have been published (LaSorte, et al. 2007).

In late 2008, a Memorandum of Understanding (MOU) between the Forest Service and the USFWS to promote the conservation of migratory birds was signed. The intent of the MOU is to strengthen migratory bird conservation through enhanced collaboration and cooperation between the Forest Service and the USFWS as well as other Federal, state, tribal and local governments. Within the NFs, conservation of migratory birds focuses on providing a diversity of habitat conditions at multiple spatial scales and ensuring that bird conservation is addressed when planning for land management activities.

Opportunities to promote conservation of migratory birds and their habitats as identified in Tables 24 and 25 of the Birds of Conservation Concern (USFWS, 2008) in the project area were considered.

3.7.4.1 Environmental Effects on Migratory Landbirds - Alternative 1 – No Action and Alternative 2 – Lands Available for Leasing

It was determined that the project would not adversely impact migratory landbird species or their associated habitats.

3.8 CULTURAL RESOURCES

3.8.1 Current Condition

The earliest mounds and mound groups in the world were built in Louisiana and Mississippi around 4500 B.C. This period of time, 5000 – 3000 B.C., is called the Middle Archaic period by archaeologists. These mounds predate the Great Wall of China, Stonehenge and the Egyptian pyramids by over a thousand years. Many archaeological resources are located on the NFsMS lands. In the north, the Chewalla Lake mound is in a major recreation site on the Holly Springs NF. The Owl Creek mound group on Tombigbee NF, just off the Natchez Trace Parkway, is an example of an interpreted site. The Deathly Silent mound on the De Soto NF is one of the few mounds in that entire portion of the state. The Chickasawhay District has mysterious xeric sites with cacti, gopher tortoises and evidence of peoples coming up from the Gulf Coast at ca. AD 1300. The Homochitto NF has yielded evidence of people living there as far back as 9500 BC. The Delta NF boasts the Little Spanish Fort site, a prehistoric earthwork and mound dating between 150 BC and AD 400.

Cultural resource significance evaluations are made with reference to the ability of a site or related group of sites to meet the criteria for eligibility to the National Register of Historic Places (NRHP). Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to provide the State Historic Preservation Officer (SHPO) and Advisory Council of Historic Places (ACHP) an opportunity to comment on any project on Federal lands within their state that would affect properties included in or eligible for inclusion in the NRHP. Section 304 directs Federal agencies to withhold from disclosure to the public information relating to the location or character of eligible properties whenever disclosure of such information may create risk or harm to such resources. NRHP eligibility criteria are specified in 36 CFR Part 60.4 and Table 18.

Table 18. Cultural Resource Significance Evaluation Criteria

The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling and association, and:
(a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
(b) that are associated with the lives of persons significant in our past; or
(c) that embody the distinctive characteristics of a type, period, method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack distinction; or
(d) that have yielded, or may be likely to yield, information important to prehistory or history.

Source: National Register of Historic Places: Listing Criteria (Online)

The ACHP regulations outline procedures to be followed by Federal agencies (51 Federal Register, 31118; 9/2/86). Federal agencies are required to consult with the SHPO to determine if a proposed undertaking encompasses any property included in or eligible for inclusion in the NHRP. For each eligible property identified, the Federal agency must determine if the proposed undertaking would have an effect. If there could be an effect, the Criteria of Adverse Effects are applied, and treatment measures are developed for resources that would be adversely affected. The regulations provide for consultation with the SHPO and ACHP to develop conditions for a MOU for protection of potential adverse effects.

Cultural resources are archaeological and historic sites located by surveys required by the Section 106 process of the NHPA. As of June 2006, the NFsMS have recorded over 8,000 such sites, with the majority being of prehistoric Native American origin. The Forest also consults with Native American groups on the management of Federal lands, as required by the NHPA and the Native American Graves and Repatriation Act. Inventory of NFS land by professional archaeologists is

ongoing. Initial survey methods include field survey and screened shovel tests. Site distributional models may be employed to determine the intensity of shovel tests.

Inventory and evaluation of heritage resources are actively pursued on each of the NFsMS. These inventories (normally and historically) have occurred prior to the initiation of ground-disturbing activities. The SHPO granted a waiver of the requirement to survey prior to ground-disturbing activity after Hurricane Katrina provided that follow-up surveys would be completed after the emergency removal of hazardous fuels. Currently, more than 350,000 acres of the total 1.2 million acres of NFS lands have had some level of survey performed.

Sites listed on the NRHP are eligible for listing on the register and are protected when project activities near the sites are implemented.

3.8.2 Environmental Effects - Alternative 1 – No Action

Under Alternative 1, there would be no effects to cultural resources within existing NFS lands that are currently not leased. NFS land under existing leases would have the same effects as Alternative 2.

3.8.3 Environmental Effects - Alternative 2 – Lands Available for Leasing

The presence of cultural resources at any specific location cannot be determined without an intensive pedestrian survey. Such surveys would be required and conducted under regulation 36 CFR Part 800. However, even if cultural resources are found at or near a proposed oil and gas exploration or development area, many such resources can be avoided with relatively small adjustments in facility locations. Many sites, whether historic or prehistoric, are small, much smaller than the provision in the BLM's Standard Lease Terms (Appendix B) for movement of proposed facilities by up to 200 meters if sensitive resources are identified. Although specific site impacts and appropriate protective measures are not known (and cannot be determined) at this time, it is possible to assess, in a general way, whether the oil and gas development alternatives are likely to result in significant impacts to cultural resources. This can be done because: 1) protection of cultural resources is required under 36 CFR Part 800, the implementing regulation for Section 106 of the NHPA and 2) no development plan for any specific oil and gas lease would be approved unless cultural resource surveys and oil and gas facility plans demonstrate that impacts to cultural resources would be less than significant.

Future applications for exploration and drilling would require the preparation of a site-specific NEPA analysis. If cultural resources are identified, their eligibility would be evaluated on a case-by-case basis. Operations would be relocated or restricted based on existing Federal regulations and policies to protect heritage resources.

A project is considered to have a potentially significant impact on heritage resources if it could adversely affect a property that is eligible for the NRHP. In accordance with 36 CFR 800.9(b), an effect is considered adverse when "it may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association." This would include any of the following potential effects:

- Physical destruction, damage, or alteration of all or part of the resource;

- Alteration of the character of the resource's setting, when the setting contributes to the significance of the resource;
- Introduction of visual, audible, or atmospheric elements that are out of character with the resource or would alter its setting;
- Neglect of the resource that could lead to its deterioration; or,
- Transfer, sale, or lease of the property.

Direct and indirect impacts to heritage resources can be reduced to below the level of significance through protective measures. For instance, where a heritage resource is eligible for the NRHP due to its informational content, the implementation of a data recovery program may reduce the impact below the level of significance. This is usually done by partially excavating the site, using methodologies defined in a reviewed and approved research design. Management of cultural resources would be accomplished through enforcement of the BLM's Standard Lease Terms (which provides that the "Lessee shall conduct operations in a manner that minimizes adverse impacts..."), in conjunction with the cultural resource regulations detailed in 36 CFR Part 800. Detailed surveys and evaluations of heritage resources, in the areas under consideration for any ground disturbance, would be conducted as part of a site-specific NEPA analysis prior to final decisions. If significant impacts to heritage resources are projected as a result of any proposed oil and gas activities, either protective measures to reduce such impacts to less than significant levels would be incorporated into the project description, or surface disturbance would not be allowed. With utilization of these procedures, and application of current laws and regulations protecting heritage resources, no significant impacts to heritage resources would result from implementation of Alternative 2.

Effects to heritage resources are expected to continue, as a result of wildfires, general forest recreation, and special uses. These effects are expected to be eliminated or reduced to a minimum with the implementation of protective measures as conditions of approval. Potential cumulative impacts associated with oil and gas development include the potential for increased site vandalism or removal of artifacts where vehicular access is increased through construction of new access roads for oil and gas equipment.

3.9 RECREATIONAL OPPORTUNITIES

3.9.1 Wilderness Areas

3.9.1.1 Current Condition

The NFsMS contains two congressionally-designated wilderness areas totaling 6,046 acres, all of which are found on the De Soto Ranger District of the De Soto NF. Management direction for these wilderness areas was developed through a public "limits of acceptable change" (LAC) process, implemented in 1994. Use of wilderness areas on NFS lands in Mississippi is considered low. Only 2,800 visits to wilderness areas on the NFsMS were reported in 2002.

Designated wilderness areas within NFsMS have traditionally offered a spectrum of primitive opportunities, such as, hiking, hunting, fishing, camping, canoeing, horse back riding, and photography. In addition to primitive recreation, designated wilderness areas also provide opportunities to study ecosystems that have not been disturbed by humans. They can provide reference conditions for vegetation, watersheds, and wildlife, serving serve as high-quality habitat for a variety of plant and animal species.

3.9.1.2 Environmental Effects - Alternative 1 – No Action

No impacts to the designated wilderness areas would occur since no leasing can occur within wilderness areas as the lands are statutorily withdrawn from leasing.

3.9.1.3 Environmental Effects - Alternative 2 – Lands Available for Leasing

No impacts to the designated wilderness areas would occur since no leasing can occur within wilderness areas as the lands are statutorily withdrawn from leasing.

3.9.2 Developed and Dispersed Recreation

3.9.2.1 Current Condition

The six NFsMS are a major provider of developed and dispersed outdoor recreation in the state. The Forest's 1.2 million acres provide a diversity of terrain and related ecosystems. Wildlife is abundant and there are numerous lakes, rivers and streams. Diverse plant and animal communities and a rich cultural history add values to the Forest visitors' experience. Forestlands are dispersed throughout Mississippi which makes them quickly accessible to visitors. Mild winters allow for year-round recreation.

Water related recreation is especially popular. Swimming, boating, and warm water fishing are favorite pastimes. Picnic sites and pavilions near the water are popular for small and large family gatherings. The Black Creek Scenic River provides a distinctive canoeing experience. In addition, developed and dispersed camping areas provide overnight accommodations that support hunting, water-based recreation and destination camping.

Hunting is an important southern tradition. Large portions of the NFsMS are managed cooperatively with MDWFP as wildlife management areas with extensive habitat improvements to support abundant game and non-game species.

Approximately 265 miles of non-motorized hiking, biking and horseback riding trails offer challenge and scenic enjoyment. There are 144 miles of designated motorized trails that are located on three of seven Ranger Districts on the Forest. Use of these motorized trail systems, primarily by motorcycle and ATV enthusiast, is high. As a result of high use, most of these trails require continual monitoring and maintenance to ensure environmental protection and user safety.

3.9.2.2 Environmental Effects - Alternative 1 – No Action

Under Alternative 1, no new oil and gas leases for exploration would be issued. However, existing leases would continue until expired, terminated or are relinquished. No direct environmental effects would result from the leasing itself. Indirect effects related to the existing leases can be estimated as discussed in the assumed projections from the BLM analysis of the RFDS.

3.9.2.3 Environmental Effects - Alternative 2 – Lands Available for Leasing

The decision to lease would not have any direct, indirect, or cumulative impacts on recreation users. However, implementing oil and gas activities and facilities could affect recreational experiences. Visitors may experience the sites, sounds, and odors associated with establishing and operating oil

and gas facilities. Impacts would increase as the distance from oil well operations decreases. Prior to drilling on any lease, a site-specific NEPA analysis would be completed and protective measures would be included in the Conditions of Approval, as part of the Lessee APD, to minimize impacts to recreational users.

3.9.3 Special Areas

3.9.3.1 Current Conditions

Special areas on the NFsMS include areas with unique or rare botanical, zoological, geological, historical, scenic, recreational, research or administrative values. They may also include good examples of more commonly encountered ecological systems, such as intact pitcher plant bogs. Table 19 displays a list of special areas, their acreage and the District on which they occur.

Table 19. Special Areas Located on the National Forests in Mississippi

Area Name	Designation	District	Acres
Bienville Pines Scenic Area	Scenic Area	Bienville	189
Proposed Singleton Prairie Botanical Area	Proposed Botanical Area	Bienville	80
Harrell Prairie Botanical Area	Botanical Area	Bienville	153
Proposed Nutmeg Hickory Research Natural Area	Proposed Research Natural Area	Bienville	307
Proposed Laurel Oak Research Natural Area	Proposed Research Natural Area	Chickasawhay	277
Unmanaged Forty	Scenic Area	Chickasawhay	41
Tiger Creek Botanical Area	Botanical Area	Chickasawhay	375
Proposed Railroad Creek Titi Botanical Area	Proposed Botanical Area	De Soto	451
Proposed Little Florida Botanical Area	Proposed Botanical Area	De Soto	121
Proposed Pitcher Plant Botanical Area	Proposed Botanical Area	De Soto	251
Proposed Buttercup Flat Botanical Area	Proposed Botanical Area	De Soto	164
Proposed Loblolly Bay Research Natural Area	Proposed Research Natural Area	De Soto	93
Red Hills Botanical Area	Botanical Area	De Soto	194
Proposed Ragland Hills Research Natural Area	Proposed Research Natural Area	De Soto	237
Proposed Granny Creek Bay Research Natural Area	Proposed Research Natural Area	De Soto	127
Harrison Experimental Forest	Experimental Forest	De Soto	4,066
Erambert Seed Orchard	Genetic Resource Management Area	De Soto	718
Black Creek Seed Orchard	Genetic Resource Management Area	De Soto	454
Black Creek Corridor	Scenic Area	De Soto	9149
Black Creek Scenic River	National Scenic River	De Soto	21 miles
Proposed Wyatt Hills Botanical Area	Proposed Botanical Area	De Soto	100
Proposed Glen's Pond Zoological Area	Proposed Zoological Area	De Soto	1,655
Harrison Research Natural Area	Research Natural Area	De Soto	113
Paul B. Johnson State Park	State Park	De Soto	153
Black Creek Wilderness Area	Wilderness Area	De Soto	5,052
Leaf River Wilderness Area	Wilderness Area	De Soto	994
Dowling Bayou Archaeological Site	Archaeological Area	Delta	10
Proposed Cypress Bayou Botanical Area	Proposed Botanical Area	Delta	262
Red Gum Research Natural Area	Research Natural Area	Delta	40
Overcup Oak – Water Hickory Research Natural Area	Research Natural Area	Delta	40
Green Ash – Sugarberry Research Natural Area	Research Natural Area	Delta	67

Area Name	Designation	District	Acres
Proposed LA-2 Botanical Area C117S17	Proposed Botanical Area	Holly Springs	12
Proposed LA-6 Botanical Area C122S	Proposed Botanical Area	Holly Springs	158
Tallahatchie Experimental Forest	Experimental Forest	Holly Springs	3,502
USDA, NRCS Jamie L. Whitten Plant Materials Center	Plant Materials Center	Holly Springs	199
Proposed Lee Creek Research Natural Area	Proposed Research Natural Area	Holly Springs	186
Proposed Sandy Creek Botanical Area	Proposed Botanical Area	Homochitto	300
Okhissa Lake & Recreational Area	Recreational Area	Homochitto	3075
Owl Creek Mounds Archaeological Site	Archaeological Area	Tombigbee	29
Proposed Shagbark Hickory Botanical Area	Proposed Botanical Area	Tombigbee	109
Proposed Choctaw #4 Botanical Area	Proposed Botanical Area	Tombigbee	45
Noxubee Crest Research Natural Area	Research Natural Area	Tombigbee	552
Chuquatonchee Bluffs Research Natural Area	Research Natural Area	Tombigbee	218
Proposed Prairie Mount Research Natural Area	Proposed Research Natural Area	Tombigbee	370
Proposed Bogue Cully proposed Research Natural Area	Proposed Research Natural Area	Tombigbee	500

Source: NFsMS

3.9.3.2 Environmental Effects - Alternative 1 – No Action

Under Alternative 1, no new oil and gas leases for exploration would be issued. However, existing leases would continue until expired, terminated or are relinquished. No direct environmental effects would result from the leasing itself. However, indirect effects from existing leases on Special Areas would be minimal, since a No Surface Occupancy stipulation would require directional drilling from an off-site location in these areas.

3.9.3.3 Environmental Effects - Alternative 2 – Consent to Leasing

The decision to lease would not have any direct, indirect, or cumulative impacts on these special areas because leases for these areas carry a No Surface Occupancy stipulation requiring drilling activity for these leases to be located off-site and use directional drilling methods to evaluate these special areas. To allow surface occupancy would reduce characteristics that make these sites unique and for which they were established including: research and development, study, observation, monitoring, and those educational activities that do not modify the conditions for which the area was established.

3.10 MILITARY TRAINING AREAS

3.10.1 Camp Keller, Harrison County

3.10.1.1 Current Condition

Camp Keller is located in the southern portion of the De Soto NF, and within the interior, unincorporated portion of Harrison County. Camp Keller has been used by the military, as a training facility, since the 1940's. Until 1991, a MOU between the Air Force and the Forest Service governed the use of NFS lands. A Special Use Permit (SUPO) between the Forest Service and Keesler Air Force Base (KAFB) was subsequently signed in November 1992. In addition, a MOU between Keesler AFB and the Naval Construction Battalion Center (NCBC) Gulfport was signed in

1984 that covered a 25-year period for use of the range and buildings in Shooting Bay 2. After the Air Force determined that it no longer had a requirement to hold a SUPO for Camp Keller, the U.S. Navy assumed responsibility for the SUPO, on a temporary basis. Under the temporary SUPO, Camp Keller met the needs of personnel combat readiness training for NCBC Gulfport. This permit allows the NCBC to utilize the 2,196 acre parcel from the Forest Service. Other users of the Range may include Keesler Air Force Base (KAFB), local law enforcement agencies, and other Department of Defense (DoD) components. Use of the Range would be provided to these others users on an “as available” basis, based on the needs of the NCBC personnel.

Currently the Navy personnel utilizes Camp Keller Shooting Bays 1 and 2 for small arms target practice and utilizes Area 4 for field training exercises including mock-ambush activities and drills. In 2005, the Forest Service issued a 20 year, long-term SUPO to the U.S. Navy for the continued use of the Camp Keller Small Arms Range. Within that SUPO, the boundaries were expanded from 2,197 acres to 2,484 acres in order to accommodate the relocation of State Highway 67, providing a prominent boundary along existing roads for the placement of warning signs and notices, and providing for safe usage of weaponry currently being used on the Range.

3.10.1.2 Environmental Effects - Alternative 1 – No Action

As of this date, there are no existing oil and gas leases or production activities on Camp Keller lands. Therefore, implementation of Alternative 1 would have no effects on Camp Keller lands.

3.10.1.3 Environmental Effects - Alternative 2 – Lands Available for Leasing

Implementation of Alternative 2 would have no effects on the designated lands of Camp Keller because the entire military base is an active, year-round military training area and if leased, leases will carry a No Surface Occupancy stipulation.

3.10.2 Camp Shelby Military Training Facility - Forrest and Perry Counties

3.10.2.1 Current Condition

The Camp Shelby Training Facility is an active military training site for Army National Guard units for summer camp, active duty training. Since September 2001, Camp Shelby has been utilized as a year-round, military training facility for not only National Guard units, but also Active Duty Army units with specialized training designed for Mid-East terrain and culture. Most of Camp Shelby lies in De Soto National Forest, Forrest and Perry Counties, which is also in the Pine Belt Physiographic Region of Mississippi (See Figure 2).

Under the current Surface Use Plan of Operation (SUPO), the Forest Service has authorized the Mississippi Military Department (MMD) to use approximately 117,000 acres of NFS lands on the De Soto NF. Under the majority of that land, the oil, gas, and other minerals are also Federally-owned. In addition to the 117,000 acres of NFS lands in this SUPO, the DoD, the State of Mississippi and private individuals also own surface and minerals within the boundaries of Camp Shelby. The right to explore for and extract these minerals is leased to private entities

The area contains minerals of economic value, such as lignite, natural gas, crude oil, gravel, and sand. Lignite occurs in thin seams at a depth of 2,000 feet, but is not likely to be developed due to its depth. Gravel and sand for construction and road maintenance have been mined from the area in the

past, and currently there are two active pits, one on National Forest lands and one on Department of Defense (DoD) lands within the Camp Shelby. Also within the area there are seven producing oil and gas wells and approximately five shut-in wells that are in a non producing status and two salt water disposal wells.

3.10.2.2 Mineral Extraction

Leasing of NFS lands for mineral exploration and extraction is not controlled by the National Guard but rather by the Forest Service and the BLM. Use of stipulations for military activities have been incorporated into the standard leases for oil and gas within the SUPO area (see Appendix B); however, some older leases, now held by production (HBP), may not have these special clauses. In the case of Federally-owned rights, leases would continue to contain the military use stipulations in the lease document. These stipulations state that the Lessee shall not conduct exploratory activities on the leased lands during periods when the National Guard had been permitted the use of the area. Such use by the National Guard would be limited to a continuous three month period out of each year; normally, but not necessarily, May 15 through August 30, and for additional periods totaling not more than 20 days. The Forest Service shall approve the dates of such use by the National Guard. The periods of use would be subject to 90 days prior public notice given by the National Guard. However, the Lessee may conduct exploratory activities on the lands under their lease during the periods when the National Guard uses the area if the Forest Service coordinates with the National Guard and approves such exploratory activities. These stipulations also identify areas that are off-limits to surface activities related to oil and gas drilling and production and also control of other areas where surface activities would be strictly controlled. Alternate provisions for exploration and extraction may occasionally be made, including revised placement of equipment, scheduling of activity, and directional drilling, where feasible.

As of March 2005, there were 32 mineral leases under the Interior Department regulations covering NFS lands within the Military SUPO area. These leases occupy 31,378 acres of NFS lands. Two of these leases, totaling 3,963 acres, are held by production (HBP) and are producing natural gas and oil.

Mineral ownership within the Federal land base is not always consistent with or bound to the surface ownership. Terminology used for minerals not owned or leased by the surface owner is typically termed “Reserved” or “Outstanding”. There are 3,381 acres of NFS lands within the permit area whose mineral rights are classified as reserved or outstanding in private ownership.

Currently there is no active production or exploration of these privately held mineral rights. It is unknown if these rights are currently held by or leased to viable oil and gas operators. Locations where private parties hold the rights must be handled on a case-by-case basis. If developed, some of these rights could have a significant impact on the National Guard’s ability to carry out training missions in the SUPO. Also, there are several producing wells on private lands and exploration is being conducted on additional private lands throughout the training site.

Assumptions and analysis of the RFDS in Camp Shelby SUPO area have been conducted by the BLM. These assumptions are necessary for a meaningful and reasonable analysis of the cumulative impacts resulting from oil and gas leasing and development. The assumptions are based on a statistical analysis of historic development.

3.10.2.3 No Surface Occupancy

No surface occupancy or use is allowed on the lands described below as they are actively used by the National Guard for impact areas, tank and artillery firing positions, small arms ranges, ammunition supply points, and safety areas around such facilities. The Lessee is authorized to employ directional drilling to exploit the mineral resources within these areas providing such drilling would not disturb or interfere with the National Guard's use of the surface.

T2N, R10W – Those lands within the East Air to Ground Range in parts of Sec. 10, 11 & 14; Sec. 15 & 16; parts of 17 & 20-23.

T2N, R11W – Part of Sec. 6; Sec. 7; part of 8 & 9; part of 14 & 15; 16-22; part of 23 & 26; 27-30; part of 31-35.

T2N, R12W – Those lands within the Multi-Purpose Range Complex – Heavy (MPRCH), MPRCH safety fan, Small Tank Fan, and ammunition supply point in parts of Sec. 1 & 2; Sec. 12 & 13; part of 14 & 23; 24 & 25; part of 26 & 35; 36.

T3N, R12W – Those lands within the MPRCH in Sec. 35 & 36; those lands within Ragland Hills RNA in all of Sec. 23 and part of Sec. 24.

For the purpose of: to comply with Amendment 12 (Record of Decision for Military Training Use of NFS Lands at Camp Shelby) of the Forest Plan, NFsMS.

Upon the written request of the Lessee or Operator, a waiver or modification may be granted to allow for occupancy of roads and the associated rights-of-way for the purpose of seismic exploration, if the authorized officer, in consultation with the National Guard, determines that the surface occupancy can be conducted without causing unacceptable impacts or risk. If approval is granted, the following would apply: 1) the Lessee assumes full obligation for any risk involved in exercise of the rights and privileges authorized by this lease; and 2) the Lessee, who for the purposes of this section shall include the Lessee's heirs, assigns, agents, employees, and contractors, shall indemnify, defend, and hold the United States harmless for any violations incurred under any such laws and regulations or for judgments, claims, or demands assessed against the United States in connection with the use or occupancy of the property by the Lessee. The Lessee's indemnification of the United States shall include any loss by personal injury, loss of life or damage to property in connection with the occupancy or use of the lands covered by this stipulation during the term of the lease.

Indemnification shall include, but is not limited to, the value of resources damaged or destroyed; the costs of restoration, clean-up or other protective measures; fire suppression or other types of abatement costs; third party claims and judgments; and all administrative, interest and other legal costs. This section shall survive the termination or expiration of the lease.

3.10.2.4 Special Stipulations For Lands in the Camp Shelby Training Area

All the lands affected by this stipulation are located in the Camp Shelby SUPO area and are subject to the following:

1. The Lessee shall not conduct exploratory activities on the lands included in this lease during periods when the Forest Service grants to the National Guard the privilege of using the area. Such use by the National Guard would be limited to a continuous three month period out of each year,

normally, but not necessarily, May 15 through August 30, and for additional periods totaling not more than 20 days. The Forest Service shall approve the dates of such use by the National Guard. The periods of use would be subject to 90 days prior public notice given by the National Guard. Provided however, the Lessee may conduct exploratory activities on the lands under this lease during the periods when the National Guard uses the area if the Forest Service coordinates with the National Guard and approves such exploratory activities.

NOTE: Following the terrorist attacks of September 11, 2001, Camp Shelby has been a full-time, year-round active military training base for National Guards units and U.S. Army units.

2. It is understood that certain lands included in this lease may have been previously, or may currently be, used as an impact area of artillery (bombing, machine gun, etc.), ranges, and other military training purposes; and

- a) That such land has been, and may be, subject to contamination by the introduction of unexploded and dangerous bombs, shell-rockets, mines, and charges either upon or below the surface thereof; and
- b) THAT THE UNITED STATES IS UNABLE TO CERTIFY THAT THE PROPERTY HAS BEEN COMPLETELY AND FULLY CLEARED AND DECONTAMINATED AND IS UNABLE TO STATE WHETHER OR NOT THE SAME IS SAFE FOR USE; and
- c) That the Lessee assumes full obligation for any risk involved in exercise of the rights and privileges authorized by this lease; and
- d) That prior to disturbance of areas officially recognized as "Surface Use Only", the Lessee would be required to contract with an individual or firm specializing in the detection and disposal of unexploded ordnances in order to "clean" the area.

3. Use or occupancy of the surface within 200 feet of the cleared right-of-way line of all regularly traveled roads, within 100 feet of stream banks, or within designated artillery firing points is limited strictly to access and facilities such as roads, power, pipe, or telephone lines which may be installed in a manner as specified by the Forest Supervisor, USDA Forest Service, Jackson, Mississippi.

The Lessee agrees to obtain written approval from the Forest Supervisor prior to installing any such facilities.

The Lessee is authorized to employ directional drilling to exploit the mineral resources within the aforementioned areas, providing such drilling would not disturb the surface.

4. Lessee would bury all gas and oil pipelines underneath the earth's surface a depth of two feet, except that such lines crossing streets and roads over which military vehicles and armored tanks usually travel shall be buried a depth of three feet underneath such streets and roads.

5. Lessee would mark with appropriate signs or markers in sufficient size lettering to warn any member or unit of the National Guard of the whereabouts of all underground pipelines and above ground facilities constructed by the Lessee.

6. Use or occupancy of the surface of designated artillery firing points is limited strictly to access and facilities such as roads and buried power, pipe, or telephone lines. These areas range from two to five acres in size. Within the buffers of such areas, surface use or occupancy may be allowed with appropriate protective measures which minimize conflicts with military use.

3.10.2.5 Environmental Effects - Alternative 1 – No Action

This analysis is for a leasing decision. There are no direct vegetation effects from leasing. Exploration and development are likely connected and follow on actions. Estimates of a RFDS were provided earlier in Chapter 2 and summarized in Table 5. Under Alternative 1, the no action would have a cumulative effect of no change.

3.10.2.6 Environmental Effects - Alternative 2 – Lands Available for Leasing

This analysis is for a leasing decision. Exploration and development are likely connected and follow on actions. Estimates of Reasonable Foreseeable Development were provided earlier in Chapter 2 and summarized in Table 8. Currently, nearly 32,000 acres of mineral rights in the Camp Shelby SUPO area are under Federal lease. Over 3,000 acres of privately owned rights exist in the SUPO area. There are production wells and active exploration activities being conducted within the SUPO at this time. The NFsMS is committed to multiple resource uses on the Forest. Military training co-exists on Camp Shelby with program areas such as timber, recreation, fire, and mineral exploration. Increased oil and gas activities could have a negative effect on military training requirements as allowed by the SUPO without the control of the No Surface Occupancy and Special stipulations added to the leases.

3.11 VISUAL RESOURCES

3.11.1 Current Condition

The Bienville NF is located in central Mississippi and offers over 178,000 acres managed for wildlife, timber, recreational areas like camping, boating, fishing, and other activities. Interstate 20 traverse through the Forest and allow easy scenic rest stops to tour the Forest.

The Delta NF is a large, contiguous block of bottomland hardwood forest, seasonally flooded timber and small sloughs draining into the Big and Little Sunflower Rivers. It is the only bottomland hardwood ecosystem in the NFS.

The De Soto NF is characterized by gently rolling terrain covered by southern pine ridges and hardwood bottoms with clear, tea-colored streams meandering throughout the Forest. Year-round recreation opportunities exist for the hiker, bicyclist, camper, canoeist, ATV rider, horse enthusiast, hunter and fisherman. Visitors who seek solitude would be able to find it within one of the De Soto's two wilderness areas, the Black Creek or Leaf. Black Creek, Mississippi's only National Scenic River, is famous for its wide, white sandbars and relaxed floating pace.

Holly Springs NF, located in north-central Mississippi, provides a panorama of habitat types for wildlife including upland hardwoods and pine forests. The Holly Springs NF, along with many partners, are striving to increase the Forest's biodiversity by restoring and protecting its unique wetland communities. Bottomland hardwoods and other wetlands provide habitat for resident and migratory wildlife not found in the prevailing wetland.

The Homochitto NF is composed of the rolling hills of southwest Mississippi and has more than 190,000 acres of managed forest for wildlife and recreation. There are many hiking trails and a nationally-recognized mountain bike trail available for enjoyment.

The Tombigbee NF has approximately 66,000 acres, which are split between the Ackerman Unit and the Trace Unit. The Tombigbee NF has numerous camping and picnic areas with Davis and Choctaw Lake providing the most facilities for recreation. The Natchez Trace National Park highway traverses through the Tombigbee NF allowing drivers to experience a historical trail from Natchez, Mississippi to Nashville, Tennessee.

3.11.2 Environmental Effects - Alternative 1 – No Action

Under Alternative 1, new leases of Federal oil and gas would not be allowed on the NFsMS. Existing Federal oil and gas leases on the NFsMS would be managed under the existing Lease terms and conditions until the leases expire, terminate or are relinquished, at which time the lands would not be available for future leasing. Oil and gas exploration and development of existing leases would continue until the existing leases expire, terminate or are relinquished.

Under Alternative 1, the no action would have a cumulative effect of no change. The cumulative effects acres of surface disturbance projected for each activity level for Alternative 1 is less than one-seventh of one percent of the NFS lands on the NFsMS.

3.11.3 Environmental Effects - Alternative 2 – Lands Available for Leasing

Indirect effects associated with implementing this alternative include the physical loss of natural-appearing landscapes and loss of visual quality associated with oil and gas leasing activities. The amount of loss depends upon visual absorption capability of the landscape, the context and intensity of the proposed activities, and existing scenic conditions. Scenic impacts are related to the size of the proposed activity and its resultant contrast in form, line, color and texture of its environmental setting. Losses of scenic quality are expected to be greatest in the exploration, development, and production stages, particularly where new roads, drill pads, structures, and other surface disturbance activities are located within landscapes having low visual absorption capability.

Oil and gas exploration and development could potentially result in direct effects and indirect effects as seen from sensitive viewpoints (i.e., major scenic byways, recreation sites, roads, and trails) and cause substantial changes in scenic conditions. Significant scenic effects could occur where strong visual contrasts could be perceived as human-caused, introduced, unnatural forms, lines, colors, or textures in the landscape. These effects might occur in the foreground, middleground, or background viewing distance zones.

Oil and gas exploration and development activities could result in high-contrast effects wherever visually contrasting elements or modifications are introduced in the characteristic landscape. Visually contrasting elements could include roads, drill pads, storage tanks, utility lines, and other facilities, as well as changes to landforms and vegetation patterns that could result from clearing and grading sites for these facilities. Essentially, any change to the form, line, color, and texture elements of the existing landscape could cause visual contrast. The introduction of visually contrasting elements or modifications of scale into the existing landscape by oil and gas activities could potentially alter the scenic quality of the area and/or impact views from sensitive viewpoints.

Exploratory drilling may result in scenic effects where this activity is visible in the foreground from sensitive viewpoints, particularly in previously undisturbed landscapes. The presence of equipment potentially could be noticeable for two to three months. Roads could be noticed for several years. If no discovery is made, equipment would be removed and the area reclaimed. Field development visible in foreground from sensitive viewpoints typically creates strong contrasts that could result in significant viewer effects. Where a field development would be seen in middleground and background views, visual contrasts could range from strong-moderate to moderate-weak, depending upon the visual absorption capability of the landscape. Oil and gas activities that result in strong visual contrasts in the foreground or middleground distance zones would tend to be dominant in the landscape and be evident to casual Forest observers, and would not meet the intent of either Retention or Partial Retention Visual Quality Objectives (VQOs).

Protective measures include restricting surface occupancy, promoting rapid revegetation, planting vegetative screens, painting equipment, and prudently locating roads and equipment. The protective measures would be developed and applied on a site-by-site basis.

The long-term effects are those resulting from oil and gas production. The reclaimed well pad, pump, storage tank, pipelines, and service road remain in place for the life of the well. These effects are generally less severe because they blend in over time as the vegetation grows. Road use can lead to dust being deposited on vegetation. Wind and rain, however, usually minimize the effect. The effects from gas wells are generally less as pump jacks are not needed and tanks are not always present. Abandonment and reclamation of well sites may bare soil and vegetation. This is a short-term effect. Effects to the visual resources on the NFsMS could also occur as a result of the development of private mineral development areas within the proclamation boundary. The cumulative effect from surface disturbance projected for each activity level for Alternative 2 is less than one-third of one percent of the NFS lands on the NFsMS.

3.12 CLIMATE CHANGE

3.12.1 Current Condition

For the NFsMS and much of the southeastern United States, climate variability and weather events such as hurricanes, heat waves, droughts, tornadoes, floods, freezes, and lightning storms have long been part of the natural environment. From a climate perspective, the southeast has some of the warmest temperatures, generally receives more rainfall than any other region, and experiences many extreme climate events (U.S. Global Change Research Program, 2001). Hurricanes are a threat to both the Gulf and Atlantic coasts, tornadoes and other intense storms can occur throughout the southeast, and weather disasters from floods to freezes can cause extreme damage.

These climate variables and associated disturbances have influenced the current makeup and geographical

Future Climate Scenarios for the Southeast

Warmer temperatures:

Maximum summer temperature increase:

Hadley model = 2.3° F (2030)

Canadian = 5° F (2030), 12° F (2100)

Mean annual temperature increase:

Hadley = 1.8° F (2030), 4.1° F (2100)

Canadian = 3° F (2030); 10° F (2100)

Higher summer heat index (average increase):

Hadley model = 8-15° F (2100)

Canadian model = 15° F (2100)

Moisture changes:

Intensified El Nino & La Nina phases as CO₂ increases.

Hadley = 20% increased moisture by 2090

Canadian = decreased moisture; droughts

Increased extreme weather events:

Droughts, floods, hurricanes, tornadoes, freezes, winds, ice storms, heat waves.

Higher sea levels for Atlantic & Gulf Coasts:

Hadley = 8-12 inch rise (2100)

Canadian = 20-24 inch rise (2100)

distribution of many ecological communities and landscapes across the South. However, the increasing changes in climate and disturbances projected for the future are expected to lead to significant alterations in our Nation's forests and the services they provide (U.S. Climate Change Science Program, 2008a). Our knowledge of how plants and ecosystems respond to the threats of a changing climate and how to react appropriately at local levels where management actions are most effective is still very limited (Solomon, 2008). Scientists have indicated that a changing climate can affect the future biodiversity and alter the function of the forest ecosystems that support these services and products (U.S. Climate Change Science Program, 2008a). Anticipated increases in extreme weather events outside the historic range of natural variability may alter the frequency, intensity, duration, and timing of disturbances such as fire, drought, invasive species, and insect and pathogen outbreaks. Changes in forest composition and growth may also have associated impacts on wildlife habitats, the supply of wood products, specialty markets, and recreational opportunities (U.S. Climate Change Science Program, 2008b; Marques, 2008).

Across the country, warming temperatures, altered precipitation patterns, rising sea levels, and increases in the number and intensity of extreme weather events are already causing observed ecological responses across the United States (U.S. Climate Change Science Program, 2008a). Although there are variations by region, overall temperatures across the nation warmed during the 20th century, with 11 of the 12 years from 1995-2006, among the warmest since instrumental record keeping was started in 1850 (U.S. Climate Change Science Program, 2008b; IPCC, 2007). Precipitation patterns and distribution also vary regionally, but the total annual precipitation in the contiguous United States has increased 6.1 percent over the last century, with about half of the increase attributed to increased storm intensity (U.S. Climate Change Science Program, 2008b; Karl and Knight, 1998). Warming temperatures contribute to sea level rise, and relative sea levels have risen 3-4 mm per year in the Mid-Atlantic States and 5-10 mm per year in the Gulf states (U.S. Climate Change Science Program, 2008b; EPA, 2007).

Over the past decade, a number of models have been developed to simulate climatic effects anticipated in the future. These scenarios are based on historical data, trends, and analysis of different plausible assumptions. While climate model simulations are continuing to be developed and refined, climate projections typically do not yet accurately address expected conditions below the regional scale in the United States. In the report by the United States Global Change Research Program on *Climate Change Impacts on the United States* (2001), the two principal models that were found to best simulate future climate change conditions for the various regions across the country were the Hadley Centre model (developed in the United Kingdom) and the Canadian Climate Centre model. Unless otherwise noted, the following discussions of climate change expectations for the southeastern United States are based on findings from the 2001 U.S. Global Change Research Program report and more recent projections in the U.S. Climate Change Science Program Reports (SAP 4.3, May, 2008a; SAP 4.4, June, 2008b).

For some aspects of climate change, virtually all models agree on the types of changes to be expected for the southern region:

- The climate is going to get warmer, especially warmer minimum winter temperatures. Both the Hadley and Canadian models show increased warming in the southeast but at different rates (see inset on Future Climate Scenarios for the southeast). Overall regional temperature changes are projected to be equivalent to shifting the climate of the Southern U.S. to the central U.S. and the central U.S. climate to the northern U.S.

- The heat index, which is a measure of comfort based on temperature and humidity, is going to rise. The principal climate model simulations agree that the heat index would increase more in the southeast than in other regions. By 2100, the heat index under the Hadley model is projected to increase by as much as 8-10°F and by over 15°F in the Canadian model. The Northeast may feel like the southeast does today, the southeast is likely to feel more like today's south Texas coast, and the south Texas coast is likely to feel more like the hottest parts of Central America.
- Threats to coastal areas would increase, including rising sea levels, beach erosion, subsidence, salt water intrusion, shoreline loss, and impacts to urban development.
- Precipitation is more likely to come in heavy, extreme events.

For other aspects, models tend to differ on expectations. The southeast is the only region where climate models are simulating large and opposite variations in precipitation patterns over the next 100 years. The Canadian model projects more extensive and frequent droughts in the southeast, starting with little change in precipitation until 2030 followed by much drier conditions over the next 70 years. The Hadley model, in contrast, suggests there would be a slight decrease in precipitation over the region during the next 30 years followed by increased precipitation. There is also uncertainty over the extent of effects of El Nino and La Nina cycles. El Nino events typically result in cooler, wetter winters in the southeast and fewer Atlantic tropical storms, while La Nina events tend to have the opposite effects with warmer, drier winters and more hurricanes.

Unexpected interactions among multiple disturbances happening at the same time add to the level of uncertainty. For example, tree growth is generally projected to be stimulated by increases in CO₂, but limits on availability of water and soil nutrients during droughts often weaken tree health leading to insect infestations or disease, which in turn promotes future fires by increasing fuel loads and further weakening tree health (Marques, 2008). Increases in extreme events and changes in disturbance patterns may have more significant impacts, at least in the near future, than long-term changes in temperature or precipitation. Natural disturbances that may be associated with climate change include hurricanes, tornadoes, storms, droughts, floods, fires, insects, diseases, and NNIS. Although disturbances are a natural and vital part of southern ecosystems, it is the change in frequency, intensity, duration, and timing exceeding the natural range of variation that is a concern (Marques, 2008). Multiple disturbances interact and further exacerbate damages. Hurricanes can cause severe disturbance that not only results in direct loss of biological communities and habitat, but the widespread damages can also shift successional direction leading to higher rates of species change and faster biomass and nutrient turnover. Invasive species and insect pests often have high reproductive rates, good dispersal abilities, and rapid growth rates enabling them to thrive in disturbed environments.

Sea level rise is regarded as one of the more certain consequences of increased global temperatures. During the past 100 years, average sea level rose 4-8 inches and is projected to rise an additional 19 inches by the year 2100 (International Panel on Climate Change, 1996). Large cities such as New Orleans, Charleston, and Houston are already impacted by frequent and intense flooding. Low-lying marshes and barrier islands off the southeast coast are considered particularly vulnerable to inundation. Based on current projections of sea-level rise, many southeastern coastal areas would lose shoreline as well as coastal wetlands and estuaries. In some areas, forests would decline due to saltwater intrusion. Storm surge is also likely to intensify as sea levels rise and barrier protections

are lost. Even if the frequency and intensity of hurricanes do not increase, these storms are expected to be more damaging when making landfall due to changes in coastal landforms.

Based on current projections, the primary regional-level effects of climate change in the southeast are expected to include: 1) warmer temperatures and a rising heat index, 2) moisture changes, 3) rising sea levels and coastal erosion, and 4) increased extreme disturbance events. Although warming temperatures, moisture changes, and rising sea levels may all have either direct or indirect future impacts on the NFsMS, the key area of climate change most likely to be a concern to the NFsMS during the next 15 years is an increase in extreme weather events and other natural disturbances. Based on current projections, the climate-related weather events and disturbance factors that are most likely to affect the NFsMS and impact Forest Plan components are:

- Hurricanes,
- Other extreme weather events,
- Outbreaks of insects, diseases, and non-native invasive species, and
- Fire.

Periods of climate change in Mississippi are not new as evidenced by the NFsMS's use of heritage resources to study past changes and man's adaptation to such change (Brookes and Twaroski, 1996; Brookes, 1996). Although the future direction of climate change may be somewhat different, the past is an indication that this has been a region of continuing disturbances and adaptations over time. The archaeological record for Mississippi delineates several past periods of major climate shifts that may provide an indication of the future including:

- The end of the Pleistocene period (10,000 B.C.) which marked the end of the Ice Age and the entry of man into Mississippi along with the extinction of many large mammals;
- The Hypsithermal event of 6500-3000 B.C. which was a period of warming associated with an expansion of prairie environments into Mississippi, lowered water levels in rivers and streams, and siltation of gravel bars; and
- The Little Ice Age of A.D. 1400-1880 which was a period of cold.

3.12.2 Environmental Effects - Alternative 1 – No Action

Under Alternative 1, no new oil and gas leases for exploration would be issued. However, existing leases would continue until expired, terminated or are relinquished. No direct environmental effects would result from the leasing itself. However, indirect effects related to the existing leases can be estimated as discussed in the assumed projections from the BLM analysis of the RFDS. Indirect effects would generally be analyzed in a site-specific NEPA analysis following the submission of an APD by the leaseholder or agent at the time drilling is proposed.

Lands available for leasing for oil and gas exploration rights would not have a direct effect on climate or climate change since total demand for fossil fuel would not likely be affected. The amount of fossil fuels burned is dependent upon consumer demand, availability of alternate fuels, alternate energy sources and economic factors such as price. The likely contribution to climate change is more dependent on how much fossil fuel is burned than where the fuel comes from.

Whether fossil fuels are obtained and burned from domestic sources or from foreign sources would not make a measurable difference in contribution to climate change.

Climate changes that are predicted through current climate change models would not have a likely effect on oil and gas exploration. Today's technology is suited for drilling and exploring for oil and gas deposits in the harshest environments from the coldest to the hottest locations on the planet. Exploration technology can accommodate drilling in dry or wet locations and even below the ocean floor.

3.12.3 Environmental Effects - Alternative 2 – Lands Available for Leasing

Under Alternative 2, new areas would be made available for leasing in addition to areas currently under existing leases (as existing leases expire, are terminated or are relinquished). As with Alternative 1, no direct environmental effects would result from the leasing itself. However, indirect effects related to existing and future leases can be estimated as discussed in the assumed projections from the BLM analysis of RFDS. Indirect effects would generally be analyzed in a site-specific NEPA analysis following the submission of an APD by the leaseholder or agent at the time drilling is proposed. While Alternative 2 would likely include an elevated level of fossil fuels being burned running powered equipment used in drilling; the effect would not be significant or easily measured in the context of the total fossil fuels consumption either statewide, regionally or globally.

As with Alternative 1, the contribution to climate change of discovered and recovered fossil fuel raw products is less significant than the demand for fossil fuel consumer products. The amount of fossil fuels burned is dependent upon consumer demand, availability of alternate fuels, alternate energy sources and economic factors such as price. The likely contribution to climate change is more dependent on how much fossil fuel is burned than where the fuel comes from. Whether fossil fuels are obtained and burned from domestic sources or from foreign sources would not make a measurable difference in contribution to climate change.

3.13 ECONOMIC EFFECTS

3.13.1 Current Condition

3.13.1.1 Federal Lease Revenues and Mississippi's 25 Percent Share from Federal Lease Revenues

For decades, oil and gas exploration and development has been part of the multiple-use management of the NFsMS. The NFsMS occupy about 67 percent of Federal onshore mineral estate in Mississippi that includes DoD, USFWS, NPS, BLM and other agencies. Federal oil and gas leases on the NFs are, by far, the largest Federal agency contributor to 1) Federal onshore lease revenue (rentals, bonuses, and production royalty) in Mississippi, and 2) Mississippi's 25 percent share of Federal onshore lease revenue.

The Federal revenue and Mississippi's 25 percent share from Federal onshore leasing from all Federal agencies in Mississippi for 1996-2008 are shown in Table 20. This data is used because it includes recent years and because it is readily accessible on the MMS website.

Table 20. Annual Federal Revenue and Mississippi's 25 Percent Share from Onshore Federal Leases in Mississippi, 1996-2008

Year	Total Production Royalty (\$)	Bonuses (\$)	Rents (\$)	Other Revenues (\$)	Total Federal Revenue (\$)	Mississippi's 25% share of federal revenue (\$)
2008	3,435,494.97	43,913.00	531,597.00	944.00	4,011,948.97	1,008,265.07
2007	2,235,095.13	3,062,110.00	707,289.00	1,886.48	6,006,380.61	1,514,390.96
2006	2,712,090.82	906,512.50	607,469.72	1,491.00	4,173,855.47	1,053,167.53
2005	2,371,075.65	409,199.00	583,429.50	(146.25)	3,363,557.90	868,566.78
2004	1,870,065.88	11,971.00	497,938.78	483.00	2,380,458.66	646,837.39
2003	1,763,265.50	339,706.50	671,165.07	192.00	2,774,329.07	726,053.89
2002	1,306,167.15	59,727.00	240,952.86	2,494.50	1,609,341.51	381,964.99
2001	1,875,462.33	230,360.00	590,998.00	1,882.00	2,698,702.33	710,452.00
2000	1,689,083.00	166,213.00	550,215.00	172,518.00	2,578,029.00	660,657.00
1999	1,014,500.00	30,595.00	705,688.00	6,681.00	1,757,464.00	413,000.00
1998	1,368,415.00	2,309,050.00	803,474.00	36,906.00	4,517,845.00	1,122,000.00
1997	1,774,451.00	1,547,472.00	520,156.00	(10,315.00)	3,831,764.00	952,000.00
1996	1,444,172.00	374,905.00	389,904.00	(402.00)	2,208,579.00	551,000.00
Source: Based on data from Minerals Management Service, U.S. Dept. of Interior website						

Table 21 is an estimate of the NFsMS contribution to the onshore Federal lease revenue in Table 20. The NFsMS accounted for \$3,723, 264 (89 percent) of the \$4,173,855 of the onshore Federal lease revenue for 2006. The assumption of 89 percent as NFsMS contribution is used to estimate the NFsMS contribution to Federal lease revenue for the years 1996-2008. Some Federal agencies in Mississippi have more restrictive missions than the multiple-use mission of the National Forests, and do not allow oil and gas leasing. As a result, the contribution of the NFsMS is greater than the National Forest's 67 percent share of the Federal land base in Mississippi.

3.13.1.2 Economic Value or Investment Generated by Federal Oil and Gas Leasing

One key indicator of economic effect is the economic value or investment generated by the drilling of oil and gas wells, and when successful, by completing the well and installing production facilities. The tens of million dollars in Federal lease revenues generated by the NFsMS in 1996-2008 (Table 19) are the result of hundreds of million dollars in investments in exploration and development on the NFsMS.

These private investments in oil and exploration and development on Federal leases are major engines of economic activity generated by Federal leasing on the NFsMS. The majority of the investment occurs in the three phases prior to actual production of oil and gas: 1) pre-drilling activity, 2) site construction and well drilling, 3) well completion and installation of production facilities.

Table 21. Estimate of Annual Revenue from Federal Oil and Gas Leases on NFsMS Contribution to 1) Federal Onshore Lease Revenue in Mississippi and 2) Mississippi's 25 Percent Share from Onshore Federal Leases in Mississippi, 1996-2008

Year	Total Federal Revenue (\$)	Mississippi's 25% share of federal revenue (\$)	Estimate of revenue from federal oil and gas leases on NFs in MS Contribution to Total Federal Lease Revenue (\$)	Estimate of revenue from federal oil and gas leases on NFs in MS Contribution to Mississippi's 25% share of federal lease revenue (\$)
2008	4,011,948.97	1,008,265.07	3,570,635	897,356
2007	6,006,380.61	1,514,390.96	5,345,679	1,347,808
2006	4,173,855.47	1,053,167.53	3,714,731	937,319
2005	3,363,557.90	868,566.78	2,993,567	773,024
2004	2,380,458.66	646,837.39	2,118,608	575,685
2003	2,774,329.07	726,053.89	2,469,153	646,188
2002	1,609,341.51	381,964.99	1,432,314	339,949
2001	2,698,702.33	710,452.00	2,401,845	632,302
2000	2,578,029.00	660,657.00	2,294,446	587,985
1999	1,757,464.00	413,000.00	1,564,143	367,570
1998	4,517,845.00	1,122,000.00	4,020,882	998,580
1997	3,831,764.00	952,000.00	3,410,270	847,280
1996	2,208,579.00	551,000.00	1,965,635	490,390
Total	41,912,256	10,608,356	37,301,907	9,441,436
Source: Based on data from Minerals Management Service, U.S. Dept. of Interior website, and the assumption that 89% of the federal lease revenue in MS is generated by federal oil and gas leases on NFs in MS.				

The pre-drilling phase (Phase 1) includes payroll, equipment and supply purchases, and contract payments for such work as geological investigation; geophysical survey; leasing and landsman services; oil/gas data base services; well site survey and plat; access road and well site design engineering; petroleum engineering; contract services; state permit preparation; Federal APD preparation; revision to access and drilling plans based on state and Federal reviews of permits, including environmental requirements; and accounting and legal services. The pre-drilling phase may generally extend for one year to a few years before well drilling.

The site construction and drilling phase (Phase 2) includes payroll, equipment and supply purchases, and contract payments for such work as clearing vegetation from access and well site; constructing access road; constructing well site; transportation and trucking equipment and supplies; drilling well; well logging; well or flow testing; fracturing; inspection of construction, drilling, and testing; geological and petroleum engineering evaluation services; accounting and legal services. The site construction and well drilling phase may generally extend for one to a few months. The result is either 1) the well is unsuccessful (non-productive); the well is plugged, and the site is reclaimed, or 2) the well is successful (productive), and work begins on Phase 3.

The well completion and installation of production facilities phase (Phase 3) includes payroll, equipment and supply purchases, and contract payments for such work as well completion; installation of production casing; installation of production facilities on well pad (pump jack, Christmas tree, separator, meter, storage tanks); clearing and construction of pipeline corridors; installation of pipelines or flow lines; petroleum engineering services; accounting and legal services.

The result of Phase 3 is that the well and associated facilities are ready to begin the multi-year production phase.

The RFDS assumes that 30 percent of the wells drilled would be productive, and thus, 70 percent of the wells would be non-productive. The economic values associated with pre-drilling activity (Phase 1) and site construction and well drilling (Phase 2) would occur with 100 percent of the wells (productive and non-productive). The additional economic values associated with well completion and installation of production facilities (Phase 3) would occur with the 30 percent of the wells that are productive.

3.13.2 Environmental Effects - Alternative 1 – No Action

Under Alternative 1, new leases of Federal oil and gas would not be allowed on the NFsMS. Existing Federal oil and gas leases on the NFsMS would be managed under the existing leases terms and conditions until the leases expire, terminate or are relinquished, at which time the lands would not be available for leasing. Oil and gas exploration and development of existing leases would continue until the existing leases expire, terminate or are relinquished.

The RFDS assumes that 30 percent of the wells drilled would be productive, and thus, 70 percent of the wells would be non-productive. The economic values associated with pre-drilling activity (Phase 1) and site construction and well drilling (Phase 2) would occur with 100 percent of the wells (productive and non-productive). The additional economic values associated with well completion and installation of production facilities (Phase 3) would occur with the 30 percent of the wells that are productive. The economic value or investment is assumed to be:

\$250,000 for Phase 1
\$1,000,000 for Phase 2
\$1,000,000 for Phase 3

Thus the investment for each non-productive well is assumed to be \$1,250,000 (Phase 1+Phase2). The investment for each productive well is assumed to be \$2,250,000 (Phase 1+Phase2+Phase 3).

For Alternative 1, the investment for projected wells drilled over 15 year RFDS on existing Federal leases on NFsMS is estimated in Table 22.

3.13.2.1 Federal Lease Revenues and Mississippi's 25 Percent Share from Federal Lease Revenues

Bonuses - Because Alternative 1 prohibits new leases, no bonuses for oil and gas leases would be collected as Federal revenue. Under Alternative 1, the multi-million dollar bonus revenues from the NFsMS to the Federal treasury and to Mississippi's 25 percent share would end immediately and permanently.

Rentals - Because Alternative 1 prohibits new leases, the rental revenues for oil and gas leases would decline as existing leases expire, terminate or are relinquished, and are not replaced by new leases. Under Alternative 1, the multi-million dollar rental revenues from the NFsMS to the Federal treasury and to Mississippi's 25 percent share would decline over the next 15 years and beyond.

Table 22. Estimate of Alternative 1 Economic Investment Associated with Drilling and Completion (including installation of production facilities if applicable) of Projected Number of Wells (productive and non-productive) Over 15 Year RFDS on Existing Federal Leases on NFsMS

National Forest	Projected Activity Level	# of Wells	Drilling of exploration wells that are unsuccessful (non-productive)		Drilling and completion of productive wells		Total Investment (\$)
			# of Wells	Investment (\$)	# of Wells	Investment (\$)	
Bienville	High	24	17	\$21,250,000	7	\$15,750,000	\$37,000,000
	Anticipated	16	11	\$13,750,000	5	\$11,250,000	\$25,000,000
	Low	8	6	\$7,500,000	2	\$4,500,000	\$12,000,000
Delta	High	0	0	\$0	0	\$0	\$0
	Anticipated	0	0	\$0	0	\$0	\$0
	Low	0	0	\$0	0	\$0	\$0
De Soto, N Unit	High	20	14	\$17,500,000	6	\$13,500,000	\$31,000,000
	Anticipated	14	10	\$12,500,000	4	\$9,000,000	\$21,500,000
	Low	7	5	\$6,250,000	2	\$4,500,000	\$10,750,000
De Soto, S Unit	High	78	55	\$68,750,000	23	\$51,750,000	\$120,500,000
	Anticipated	52	36	\$45,000,000	16	\$36,000,000	\$81,000,000
	Low	27	19	\$23,750,000	8	\$18,000,000	\$41,750,000
Holly Springs, N Unit	High	0	0	\$0	0	\$0	\$0
	Anticipated	0	0	\$0	0	\$0	\$0
	Low	0	0	\$0	0	\$0	\$0
Holly Springs, S Unit	High	1	0	\$0	1	\$2,250,000	\$2,250,000
	Anticipated	1	0	\$0	1	\$2,250,000	\$2,250,000
	Low	1	0	\$0	1	\$2,250,000	\$2,250,000
Homochitto	High	78	55	\$68,750,000	23	\$51,750,000	\$120,500,000
	Anticipated	52	36	\$45,000,000	16	\$36,000,000	\$81,000,000
	Low	26	18	\$22,500,000	8	\$18,000,000	\$40,500,000
Tombigbee, N Unit	High	14	10	\$12,500,000	4	\$9,000,000	\$21,500,000
	Anticipated	9	7	\$8,750,000	2	\$4,500,000	\$13,250,000
	Low	5	4	\$5,000,000	1	\$2,250,000	\$7,250,000
Tombigbee, S Unit	High	2	1	\$1,250,000	1	\$2,250,000	\$3,500,000
	Anticipated	1	0	\$0	1	\$2,250,000	\$2,250,000
	Low	1	1	\$1,250,000	0	\$0	\$1,250,000
Totals	High	217	152	\$190,000,000	65	\$146,250,000	\$336,250,000
	Anticipated	145	100	\$125,000,000	45	\$101,250,000	\$226,250,000
	Low	75	53	\$66,250,000	22	\$49,500,000	\$115,750,000

Source: NFsMS estimate based on RFDS and assuming investment of \$250,000 for pre-drilling activity, \$1,000,000 for site construction and well drilling, and \$1,000,000 for well completion and installation of production facilities.

Royalty - Because Alternative 1 restricts new production to existing leases, the potential for new production to replace declining production and to maintain royalty streams is restricted. Under Alternative 1, multi-million dollar royalty revenues from the NFsMS to the Federal treasury and to Mississippi's 25 percent share would continue for several years but then the royalties would decline more rapidly compared with Alternative 2. In terms of total production royalty over the life of new wells, Alternative 1 would likely yield tens of millions of dollars less than Alternative 2.

3.13.3 Environmental Effects - Alternative 2 – Lands Available for Leasing

Under Alternative 2, new leases of Federal oil and gas would be allowed on the NFsMS. Several hundred thousand acres of NFS lands not currently leased would be made administratively available, and the Forest Service would authorize these specific lands for leasing as well as any lands where existing leases expire, terminate or are relinquished. Oil and gas exploration and development would occur on the new leases as well as the existing leases.

In addition to the economic activity or investments generated by Alternative 1, Alternative 2 includes the economic activity or investments generated by allowing leases on several hundred thousand acres

not currently leased and on any lands where existing leases expire, terminate or are relinquished. Under Alternative 2, the investment for projected wells drilled over 15 year RFDS on Future Federal leases on NFsMS is estimated in Table 23.

Table 23. Estimate of Economic Investment Associated with Drilling and Completion (including installation of production facilities if applicable) of Projected Number of Wells (productive and non-productive) Over 15 Year RFDS on Future Federal Leases on NFsMS

National Forest	Projected Activity Level	# of Wells	Drilling of exploration wells that are unsuccessful (non-productive)		Drilling and completion of productive wells		Total Investment (\$)
			# of Wells	Investment (\$)	# of Wells	Investment (\$)	
Bienville	High	28	20	\$25,000,000	8	\$18,000,000	\$43,000,000
	Anticipated	18	13	\$16,250,000	5	\$11,250,000	\$27,500,000
	Low	9	6	\$7,500,000	3	\$6,750,000	\$14,250,000
Delta	High	6	4	\$5,000,000	2	\$4,500,000	\$9,500,000
	Anticipated	4	3	\$3,750,000	1	\$2,250,000	\$6,000,000
	Low	2	1	\$1,250,000	1	\$2,250,000	\$3,500,000
De Soto, N Unit	High	41	29	\$36,250,000	12	\$27,000,000	\$63,250,000
	Anticipated	28	20	\$25,000,000	8	\$18,000,000	\$43,000,000
	Low	14	10	\$12,500,000	4	\$9,000,000	\$21,500,000
De Soto, S Unit	High	122	85	\$106,250,000	37	\$83,250,000	\$189,500,000
	Anticipated	81	57	\$71,250,000	24	\$54,000,000	\$125,250,000
	Low	41	29	\$36,250,000	12	\$27,000,000	\$63,250,000
Holly Springs, N Unit	High	6	4	\$5,000,000	2	\$4,500,000	\$9,500,000
	Anticipated	5	3	\$3,750,000	2	\$4,500,000	\$8,250,000
	Low	3	2	\$2,500,000	1	\$2,250,000	\$4,750,000
Holly Springs, S Unit	High	3	2	\$2,500,000	1	\$2,250,000	\$4,750,000
	Anticipated	2	1	\$1,250,000	1	\$2,250,000	\$3,500,000
	Low	1	0	\$0	1	\$2,250,000	\$2,250,000
Homochitto	High	135	94	\$117,500,000	41	\$92,250,000	\$209,750,000
	Anticipated	90	63	\$78,750,000	27	\$60,750,000	\$139,500,000
	Low	45	31	\$38,750,000	14	\$31,500,000	\$70,250,000
Tombigbee, N Unit	High	7	5	\$6,250,000	2	\$4,500,000	\$10,750,000
	Anticipated	5	3	\$3,750,000	2	\$4,500,000	\$8,250,000
	Low	2	1	\$1,250,000	1	\$2,250,000	\$3,500,000
Tombigbee, S Unit	High	1	0	\$0	1	\$2,250,000	\$2,250,000
	Anticipated	1	0	\$0	1	\$2,250,000	\$2,250,000
	Low	0	0	\$0	0	\$0	\$0
Totals	High	349	243	\$303,750,000	106	\$238,500,000	\$542,250,000
	Anticipated	234	163	\$203,750,000	71	\$159,750,000	\$363,500,000
	Low	117	80	\$100,000,000	37	\$83,250,000	\$183,250,000

Source: NFsMS estimate based on RFDS and assuming investment of \$250,000 for pre-drilling activity, \$1,000,000 for site construction and well drilling, and \$1,000,000 for well completion and installation of production facilities.

Because Alternative 2 includes the existing leases of Alternative 1, the total value of the investment generated by Alternative 2 is the combination of investments from Alternative 1 (Table 22) with the investments from future leases (Table 23), and is shown in Table 22. A comparison of the economic investments generated by Alternatives 1 and 2 is also shown in Table 24.

3.13.3.1 Federal Lease Revenues and Mississippi's 25 Percent Share from Federal Lease Revenues

Bonuses - Because Alternative 2 allows new leases, the multi-million dollar bonus revenues from the NFsMS to the Federal treasury and to Mississippi's 25 percent share would likely continue, and potentially increase over the next 15 years and beyond.

Table 24. Comparison of Alternatives Based on Estimate of Economic Investment Associated with Drilling and Completion (including installation of production facilities if applicable) of Projected Number of Wells (productive and non-productive) Over 15 Year RFDS on NFsMS

National Forest	Projected Activity Level	Alternative 1		Alternative 2	
		# of Wells	Investment (\$)	# of Wells	Investment (\$)
Bienville	High	24	\$37,000,000	52	\$80,000,000
	Anticipated	16	\$25,000,000	34	\$52,500,000
	Low	8	\$12,000,000	17	\$26,250,000
Delta	High	0	\$0	6	\$9,500,000
	Anticipated	0	\$0	4	\$6,000,000
	Low	0	\$0	2	\$3,500,000
De Soto, N Unit	High	20	\$31,000,000	61	\$94,250,000
	Anticipated	14	\$21,500,000	42	\$64,500,000
	Low	7	\$10,750,000	21	\$32,250,000
De Soto, S Unit	High	78	\$120,500,000	200	\$310,000,000
	Anticipated	52	\$81,000,000	133	\$206,250,000
	Low	27	\$41,750,000	68	\$105,000,000
Holly Springs, N Unit	High	0	\$0	6	\$9,500,000
	Anticipated	0	\$0	5	\$8,250,000
	Low	0	\$0	3	\$4,750,000
Holly Springs, S Unit	High	1	\$2,250,000	4	\$7,000,000
	Anticipated	1	\$2,250,000	3	\$5,750,000
	Low	1	\$2,250,000	2	\$4,500,000
Homochitto	High	78	\$120,500,000	213	\$330,250,000
	Anticipated	52	\$81,000,000	142	\$220,500,000
	Low	26	\$40,500,000	71	\$110,750,000
Tombigbee, N Unit	High	14	\$21,500,000	21	\$32,250,000
	Anticipated	9	\$13,250,000	14	\$21,500,000
	Low	5	\$7,250,000	7	\$10,750,000
Tombigbee, S Unit	High	2	\$3,500,000	3	\$5,750,000
	Anticipated	1	\$2,250,000	2	\$4,500,000
	Low	1	\$1,250,000	1	\$1,250,000
Totals	High	217	\$336,250,000	566	\$878,500,000
	Anticipated	145	\$226,250,000	379	\$589,750,000
	Low	75	\$115,750,000	192	\$299,000,000

Source: NFsMS estimate based on RFDS and assuming investment of \$250,000 for pre-drilling activity, \$1,000,000 for site construction and well drilling, and \$1,000,000 for well completion and installation of production facilities.

Rentals - Because Alternative 2 allows new leases, the multi-million dollar rental revenues from the NFsMS to the Federal treasury and to Mississippi's 25 percent share would likely continue, and potentially increase over the next 15 years and beyond.

Royalty - Because Alternative 2 allows new leases and new production over a far larger area than Alternative 1, the potential for new production to replace declining production and to maintain royalty streams is much greater. Under Alternative 2, multi-million dollar royalty revenues from the NFsMS to the Federal treasury and to Mississippi's 25 percent share would continue for more years than Alternative 1, and potentially may increase. In addition, over time the royalties would decline less rapidly compared with Alternative 1. In terms of total production royalty over the life of new wells, Alternative 2 would likely yield tens of millions of dollars more than Alternative 1.

CHAPTER 4

LIST OF PREPARERS AND CONSULTATION

4.1 LIST OF PREPARERS

Allen, Dave	U.S. Forest Service, Wiggins, MS	Military
Bingham, Steve	U.S. Forest Service, Jackson, MS	Roads
Bradford, Bob	U.S. Forest Service, Jackson, MS	Climate Change, NEPA
Brookes, Sam	U.S. Forest Service, Jackson, MS	Cultural Resources
Collins, Thomas	U.S. Forest Service, Roanoke, VA	Geologist
Curtis, James	U.S. Forest Service, Forest, MS	Soils, Water Quality
Dillard, Rick	U.S. Forest Service, Jackson, MS	Wildlife, MIS
Gainey, Jeff	U.S. Forest Service, Jackson, MS	Special Areas. Recreation, Visual,
Goldsmith, Gala	U.S. Forest Service, Jackson, MS	Water Quality, Air Quality, Soils
Gordon, Ken	U.S. Forest Service, Meadville, MS	Botany/Ecology
Michael, James	U.S. Forest Service, Jackson, MS	Team Leader, Minerals
Miller, Brenda	U.S. Forest Service, Jackson, MS	GIS
Williamson, Shaun	U.S. Forest Service, Jackson, MS	T & E, MIS, BA
Windham, Jerry	U.S. Forest Service, Jackson, MS	Old Growth, Vegetation, Botanical/RNA
Long, Jeff	U.S. Forest Service, Jackson, MS	NEPA, Forest Plan Team Leader
Bagnall, William	BLM, Eastern States, Jackson, MS	Geologist
Dykes, John, P.E.	BLM, Eastern States, Jackson, MS	AFM Mineral Resource
Johnson, Lars	BLM, Eastern States, Jackson, MS	Geologist
Langley, Paula	BLM, Eastern States, Milwaukee, WI	Geologist
Schooler, James	BLM, Eastern States, Jackson, MS	GIS Specialist
Tamm, Lucille	BLM, Eastern States, Milwaukee, WI	Geologist
Burell, Rebecca	Mississippi State University	Graduate Student
McKee, Jay	Mississippi State University	Graduate Student
Schmitz, Darrel, Dr.	Mississippi State University	Head of Department

4.2 LIST OF INDIVIDUALS AND ORGANIZATIONS CONTACTED

Michael A. Berk	Henry S. Humphrey
Judith Edwards Breland, Ph.D.	James Johnston
Charles Chapman	W. Douglas Mann, Jr.
J. F. Clark	Julia O'Neal
Mike Collier	Thomas L. Price
Walter Dennis	Dennis Riecke
Bridgette K. Ellis	Travis Jubel Rutland
Marc D. Fink	Ross A. Sherman
Marlon K. Foster	Robert Smistik
Rick Green	Larry J. Smith
Steve Gullede	Russell R. Stewart
Allen Hughes	Ray Vaughan

This page intentionally left blank.

CHAPTER 5

REFERENCES

- Bormann, F.H. and Likens, G.E., 1979, Catastrophic Disturbance and the Steady State in Northern Hardwood Forests: American Science, v. 67, no. 6, p. 660-669.
- Brittingham, M.C., and S.A. Temple, 1983. Have cowbirds caused forest songbirds to decline? Bioscience 33:31-35.
- Brookes, Samuel O. 1996. Aspects of the Middle Archaic: the Atassa. In Results of Recent Archaeological Investigations in the Greater Mid-South: Proceedings of the 17th annual Mid-South archaeological conference, Memphis, Tennessee. Edited by C.H. McNutt, Occasional Paper No. 18, Anthropological Research Center University of Memphis, Memphis, TN. June 29-30, 1996.
- Brookes, Samuel O. and Melissa Twaroski. 1996. *Early Holocene Climate in the Eastern United States: a View from Mississippi*. Paper presented at the 61st annual Society for American Archaeology meeting in New Orleans, LA. USDA Forest Service, Jackson, MS; Atlanta, GA.
- Brothers, T.S. and Springarn, A., 1992. Forest fragmentation and alien plant invasion of central Indiana old-growth forests. *Conserv. Biol.* 6. Pp. 91-100.
- Dale, V., L. Joyce, S. McNulty, R. Neilson, M. Ayres, M. Flannigan, P. Hanson, L. Irland, A. Lugo, C. Peterson, D. Simberloff, F. Swanson, B. Stocks, and B. M. Wotton. 2001. Climate change and forest disturbances. *BioScience*, vol. 51, No. 9.
- Davis, Bob. 2007. *Integrating Climate Change into Forest Plans*. Forest Service, U.S. Department of Agriculture.
- EIA, 2008, "Official Energy Statistics from the U.S. Government". [online] URL: http://www.eia.doe.gov/oil_gas/petroleum/info_glance/petroleum.html.
- Gilpin, M. E., and M. E. Soulé. 1986. Minimum viable populations: processes of species extinction. Pages 19–34 in M.E. Soulé, editor. *Conservation biology: the science of scarcity and diversity*. Sinauer Associates, Sunderland, Massachusetts.
- Harris, L. D. 1984. *The fragmented forest: island biogeography theory and the preservation of biotic diversity*. University of Chicago Press, Chicago, Illinois.
- International Panel on Climate Change. 1998. *The Regional Impacts of Climate Change: an Assessment of Vulnerability*. United Kingdom: Cambridge University Press. 514 pp.

- Jacquart EM, Armentano TV, Spingarn AL. 1992. Spatial and temporal tree responses to water stress in and old-growth deciduous forest. *Am Midl Nat* 127:158-171
- Karl, T.R., and R.W. Knight. 1998. Secular trends of precipitation amount, frequency, and intensity in the United States. *Bulletin of the American Meteorological Society*, 79(2), PP. 231-241.
- La Sorte, Frank A.; Thompson, Frank R., III; Trani, Margaret K.; Mersmann, Timothy J. 2007. Population trends and habitat occurrence of forest birds on southern national forests, 1992-2004. Gen. Tech. Rep. NRS-9. Newton Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 260.
- Lovejoy, T. E., R. O. Bierregaard Jr., A. B. Rylands, J. R. Malcolm, C. E. Quintela, L. H. Harper, K. S. Brown Jr., A. H. Powell, G. V. N. Powell, H. O. Schubart, and M. B. Hays. 1986. Edge and other effects of isolation on Amazon forest fragments. Pages 257–285 in M. E. Soulé, editor. *Conservation biology: the science of scarcity and diversity*. Sinauer, Sunderland, Massachusetts.
- Marks, P.L., and F.H. Borman, 1972. Revegetation following forest cutting; mechanisms for return to steady-state nutrient cycling. *Science* 176:914-915.
- Marques, Livia. 2008. *The Fate of Southern Forests*. Compass, Issue 10. Southern Research Station, Forest Service, USDA.
- McNulty, Steve G., P.L. Lorio, Jr., M.P. Ayres, and J.D. Reeve. 1998. Predictions of southern pine beetle populations using a forest ecosystem model. In *The Productivity and Sustainability of Southern Forest Ecosystems in a Changing Environment*, edited by R. Mickler and S. Fox. Springer Publishing, pp. 617-634.
- MDEQ, 2006, State of Mississippi Ground Water Quality Assessment
- Miller, R.L., and L.D. Harris, 1977. Isolation and extirpations in wildlife reserves. *Biological Conservation* 12:311-315.
- Mississippi's Best Management Practices Handbook – 4th Edition, September 2008.
[online] URL: http://www.mfc.state.ms.us/pdf/Mgt/WQ/Entire_bmp_2008-7-24.pdf
- Mississippi Commission of Environmental Quality “Air Emission Regulations for the Prevention, Abatement, and Control of Air Contaminants” (APC-S-1, APC-S-2), amended December 2008. [online] URL: <http://www.airnow.gov>.
- Mississippi Department of Wildlife, Fisheries, and Parks. 1992. *Endangered Species of Mississippi*, Museum of Natural Science.
- Morrow, J.V., Jr., J.P. Kirk, K.J. Killgore, H. Rogillio, and C. Knight. 1998. Status and Recovery Potential of Gulf Sturgeon in the Pearl River System, Louisiana-Mississippi. *Trans. Am. Fish. Soc.* 127:798-808.

MSNF, 2006, National Forests in Mississippi Monitoring and Evaluation Report

Natural Resources Conservation Service (NRCS), United States Department of Agriculture. Official Soil Series Descriptions [Online WWW]. [online] URL: "http://soils.usda.gov/technical/classification/osd/index.html" [Accessed 01 February 2008].

Natureserve: An online encyclopedia of life (web application). 2004. Arlington, Va. [online] URL: <http://www.NatureServe.org>.

O,Hara, 1996, Susceptibility of Ground Water to Surface and Shallow Sources of Contamination in Mississippi.

Ranney, J.W., M.C. Bruner, and J.B. Levenson. 1981. The importance of edge in the structure and dynamics of forest islands. Pages 67-95 in R.L. Burgess and D.M. Sharp, editors. Forest island dynamics in a man-dominated landscape. Springer-Verlag, New York.

Records of Public-Supply Wells in Mississippi, 1991, U. S. Geological Survey Open-File Report 92-82.

Saunders, D A, Hobbs, R J and Margules, C R 1991 Biological consequences of ecosystem fragmentation a review – *Cons Biol* **5** 18–32.

Shows, T. N. 1970, Water Resources of Mississippi, Bulletin 113; Mississippi Geological, Economic and Topographical Survey.

Solomon, Alan. 2008. *Forests and global climate change*. Compass, Issue 10. Southern Research Station, Forest Service, U.S. Department of Agriculture.

Soulé, M. E. 1987. Where do we go from here? Pages 175–183 in M. E. Soulé, editor. Viable populations for conservation. Cambridge University Press, Cambridge, England.

Stewart, R.A., 2003, Physiographic Regions of Mississippi: Handout, Department of Biological Sciences, Delta State University, 6 pp.

Swank, W.T. and Douglass, J.E., 1977, Nutrient Budgets for Undisturbed and Manipulated Hardwood Forest Ecosystems in the Mountains of North Carolina: Watershed Research in Eastern North America: A workshop to compare results Feb 28-Mar 3, 1977, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, Smithsonian Institute, Tidemark Printing, Inc., Edgewater, Vol. I, p 343-363.

Temple, S.A. 1984. Predicting impacts of habitat fragmentation on forest birds: a comparison of two models. Pages 301-304 in J. Verner, M.L. Morrison, and C.J. Ralph, editors. *Wildlife 200: modeling habitat relationships of terrestrial vertebrates*. University of Wisconsin Press, Madison, Wisconsin, USA.

- The Forest Landowner and Water Quality, Mississippi Forestry Commission Publication #104.[online]URL:<http://www.mfc.state.ms.us/pdf/Pubs/10407%20Forest%20Landowner%20an%20Water%20Quality.pdf>.
- U.S. Climate Change Science Program. 2008a. *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States*. Synthesis and Assessment Product 4.3. May 2008.
- U.S. Climate Change Science Program. 2008b. *Preliminary Review of Adaptation Options for Climate-Sensitive Ecosystems and Resources*. Synthesis and Assessment Product 4.4. June 2008.
- U.S. Climate Change Science Program. October 2008. *Forest Service Strategic Framework for Responding to Climate Change*. Version 1.0.
- U.S. Climate Change Science Program. 2008. *Global Change Research Strategy 2009-2019*. Research and Development.
- U.S. Department of Interior. Bureau of Land Management. 2005. *Mississippi National Forests - Reasonable Foreseeable Development Scenario*. Final Report, October 14, 2005. Eastern States, Milwaukee Field Office.
- U.S. Environmental Protection Agency. 2007. *Proposed Indicators for the U.S. EPA's Report on the Environment (External Peer Review)*.
- USDA Forest Service. 1985. Land and Resource Management Plan, National Forests in Mississippi. USDA, Forest Service, Southern Region.
- USDA Forest Service. 2005. Management Indicator Species, Population and Habitat Trends, National Forests in Mississippi.
- USDA Forest Service. 2006. Roads Analysis, National Forests in Mississippi. USDA, Forest Service, Southern Region.
- USDA Forest Service Riparian Protection and Restoration: Road Design Techniques: 0225 1202-SDTDC, August 2002.
- USDA Forest Service Soil and Water Road-Condition Index Field Guide: 0877 1806-SDTDC, December 2008.
- USDA-U.S. Fish and Wildlife Service. 2003. Red-cockaded Woodpecker Recovery Plan for the Red-cockaded Woodpecker. 2nd revision, signed 1/27/030. 296 pp.
- U.S. Global Change Research Program, National Assessment Synthesis Team. 2001. *Climate Change Impacts on the United States – The Potential Consequences of Climate Variability and Change*. United Kingdom: Cambridge University Press, 612 pp.

U.S. Environmental Protection Agency. 2007. *Proposed Indicators for the U.S. EPA's Report on the Environment (External Peer Review)*.

Wilcox, B.A. 1980. Insular ecology and conservation. Pages 95-117 in M.E. Soule and B.A. Wilcox, editor. *Conservation biology: an evolutionary-ecological perspective*. Sinauer, Sunderland, Massachusetts, USA.

Wales, B.A. 1972. Vegetation analysis of north and south edges in a mature oak-hickory forest. *Ecological Monographs* 42:451-471.

Walters, C.J., and C.S. Holling. 1990. Large-scale management experiments and learning by doing. *Ecology* 71:2060-2068.

Water Resources of Mississippi, Bulletin 113: Mississippi Geological, Economic and Topographical Survey, T. N. Shows, 1970.

40 C.F.R. Part 61, Federal Clean Air Act, as amended. [online] URL: <http://www.airnow.gov>.

<http://www.deq.state.ms.us/newweb/MDEQPres.nsf/28ce80ddea27fe0886256b28006d8a70/d39380cdca5b2c50862574ac00540813?OpenDocument>.

<http://www.ferc.gov/industries/gas/enviro/wetland.pdf>.

This page intentionally left blank.